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PAPILLARY CYSTADENOMA IN A SUPERNUMERARY OVARY[1]

BY ROBERT T. FRANK, A. M., M. D., NEW YORK CITY
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A FULL discussion of the rare condition illustrated by the case presented below has been given by Seitz (1) and by Stolz (2). It will suffice in this clinical report, to mention that third ovaries are uncommon and are discovered as accidental findings during operation or post-mortem, unless, as in the present instance, they are the seat of a neoplasm, which increases their size, and renders their recognition more easy.

Third ovaries, if of equal functional importance to the usual paired glands, i. e., equipped with an accompanying tube, are called *supernumerary*; if merely ovarian tissue, situated either intraperitoneally or retroperitoneally, without tube or ovarian ligament, are classified as *accessory* glands. Supernumerary ovaries have been found but five times. (Seitz loc. cit.) *Intraperitoneal* accessory ovaries, that is, small masses of ovarian tissue near the normal gland, and frequently in direct connection with it, are common, Beigel (3) finding 23 in 500 post-mortems, v. Winckel (4) discovering 18 in an equal number of examinations. *Retroperitoneal* accessory ovaries have been very infrequently encountered, except when enlarged by some new growth. Manton (5) reported an accessory ovary, removed by vaginal section from the sub-peritoneal tissue of Douglas' cul-de-sac, the small mass having caused pain locally. With this exception, all other reports deal with tumors of the accessory gland. Stolz (l. c.) was able to collect 36 cases, which include tumors of both intra and retroperitoneal origin, while Seitz found but eight cases of tumors originating in a retroperitoneal accessory ovary. The following case must be added to the five cases of supernumerary ovary above cited.

Annie Seaborn, 45 years old. Admitted August 1st to the first Gynecological Service. Discharged August 29, 1908.

Menstruation began at 15 years; regular, 4 weekly 3-5 days; last period 10 days ago.

Married 21 years, never pregnant. Operated upon 15 years ago for sterility. Always constipated, otherwise well and healthy.

Present History. Has been losing strength and feeling generally weak for one year. Complains of dull pain in lower abdomen, at times radiating upward. For the last month noticed increase in the size of lower abdominal region. No fever or urinary symptoms, no loss of weight. Has a profuse leucorrhœa for many years.

Physical Examination. Fairly well nourished; slight dullness at left apex, otherwise thorax is negative.

A globular mass reaches from the symphysis almost to the umbilicus, extending higher on the left than on the right side. The mass is not movable and not tender. Toward the left the mass is cystic (?).

Vaginal Examination. Introitus small and normal. Cervix is displaced far posteriorly and low. The anterior fornix is occupied by a large, hard bulging mass, continuous with the abdominal tumor. On the left side the mass reaches to the pelvic wall. No adnexa could be felt.

Hemoglobin 83 per cent; temperature 99°; pulse 98.

Operation August 3d. *Panhysterectomy with vaginal drainage, bilateral salpingo-öphorectomy,*

[1] Read before the Harlem Medical Association, October 7, 1908.

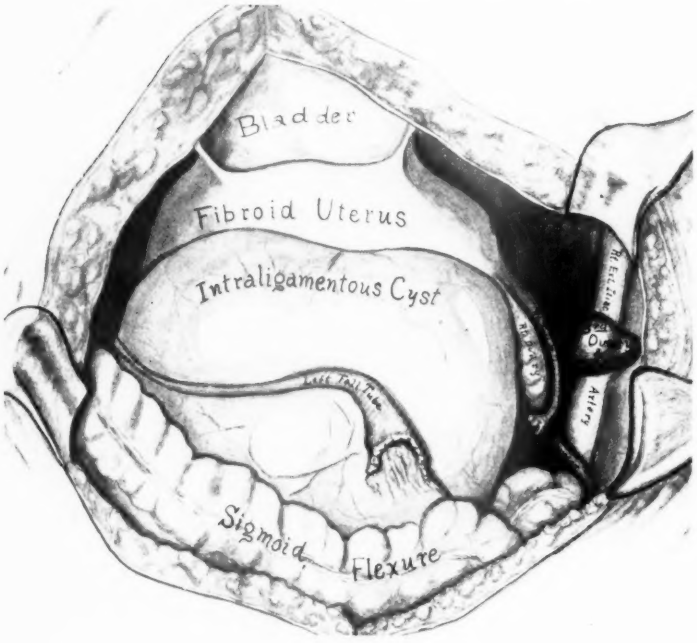

Fig. 1.

removal of cystic tumor over right external iliac artery. Long median incision below the umbilicus. The sigmoid presented transversely across the upper angle of the wound, its mesentery being occupied by a cystic tumor about the size of a large grape fruit. This cyst had developed intraligamentously, reaching well to the brim of the false pelvis on the left side, and almost to that of the true pelvis on the right. Below and in front of the cyst was a fair-sized fibroid, developed sub-peritoneally and occupying nearly the entire pelvis. The relations of these structures will be seen in Fig. 1, which shows the condition as seen after the adhesions on the right side had been broken up. The peritoneum behind the left tube, which crossed the cyst from left to right, was incised, and the cyst quite readily shelled out without appreciable hæmorrhage. The right ovarian artery and the two round ligaments were next ligated, the left ovarian vessels not being found at this stage. By freeing the bladder and exerting strong upward traction, it was found possible to disengage the fibroid from its cellular bed; the cervix was then cut across from before backward and the uterine arteries caught as they presented. The right ovary and tube were now completely freed from adhesions and removed with the specimen. Hemorrhage high up on the left side (retroperitoneal) due to the left ovarian vessels, which had apparentl taken an anomalous course and could not be located while removing the cyst, was checked by ligating these vessels nearly at the level of the kidney. Over the right external iliac artery, but beneath the normal appearing peritoneum, was a cystic mass, the size of a walnut, and external to this a smaller harder mass. The peritoneum was split, and the two masses bluntly freed and removed. The peritoneal slit was then closed.

The remains of the cervix were excised, the vaginal edges secured by suture, and two gauze drains led out through the vagina. By uniting the lower flap of the wound in the sigmoid meso-colon to the peritoneum of the bladder, the entire operative area was rendered extraperitoneal. Layer suture of the abdominal wall.

Specimens. The inner surface of the large intraligamentous cyst was covered with papillary excrescences. The cyst fluid was dark green and contained much cholesterin. The fibroid was of the intramural variety. The left tube had been much elongated. The right ovary and tube were normal. The small retroperitoneal cyst, situated over the external iliac artery, was also papilliferous. A duct, which had every appearance of a normal appearing Fallopian tube, was found upon careful dissection, closely adherent to this small cyst and also retroperitoneal. The fimbriated end could be demonstrated after dissection, lying external to the cyst and forming a closed cavity. From the fimbria the tubal lumen was traced

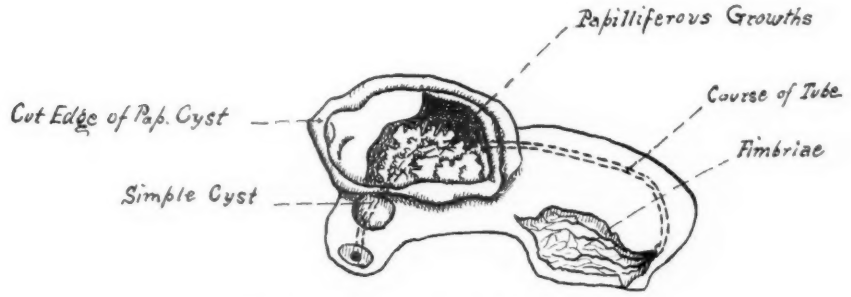

Fig. 2. Third tube and ovary (natural size).

inward and running below the cyst to the mesial end of the tumor. (Fig. 2). Whether there was any direct connection with the uterine cavity must remain an open question, as the rare condition encountered was not recognized at operation, and no attempt to trace the relations of the uterus to these structures was made. The tube, on cross section, showed the usual change from elliptical to circular form when traced from without inward. The solid mass, situated external to the cyst, on section, proved a hyperplastic lymphnode.

Convalescence was uneventful, the gauze being removed on the 7th day, patient leaving the hospital the 26th day.

Microscopical examination of the small cyst, found lying behind the peritoneum over the right external iliac artery, disclosed a small cystadenoma papilliferum, similar to that developed from the left ovary. The cyst wall at one spot contained ovarian stroma in which were a few Graafian follicles and a corpus albicans (?). In other parts of the cyst wall were adenomatous structures, appearing as simple lumina, with occasional branches, some of them with mantles of muscle fibres, probably derived from rests of the Wolffian body. The duct, running by the third ovary, as seemed probable from its gross appearance, proved, on section, to be a typical Fallopian tube with normal mucosa thrown into folds, circular and longitudinal muscle layer, with connective tissue externally, the peritoneal coat alone being absent.[1]

To recapitulate: The left ovary was represented by a large cystadenoma papilliferum of intraligamentous development, the elongated left tube extending across the tumor in a typical manner. The right ovary and tube were perfectly normal, intraperitoneal, and retained their proper relation to the uterus. The supernumerary ovary was situated at least 6 cm. away from the right ovary, showed no connection with it, and was distinctly retroperitoneal. It was accompanied by a normal tube. The unusual, i. e. retroperitoneal, situation of these supernumerary organs will be more readily accepted, if we recall that the uterus itself showed sub-peritoneal development, and that the left ovary had likewise enlarged upward by separating the sigmoid meso-colon. At operation the small mass was regarded as a glandular metastasis of the left ovarian tumor, additional color being lent to this supposition by the discovery of the adjacent enlarged lymphnode above-mentioned.

Third ovaries are of twofold interest, firstly to the embryologist, to whom all malformations are of importance, as they throw valuable sidelights upon development, in this case upon the descent of the ovary; secondly to the clinician, as cases such as this may serve to explain instances in which menstruation persists after double oöphorectomy (Green and Hunter, (6) or account for the unusual location of tumors, evidently ovarian in origin.

[1] I am greatly indebted to Dr. Wessler, of the Pathological Laboratory, for the numerous sections cut for me.

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IDIOPATHIC PROGRESSIVE CURVATURE OF THE RADIUS, OR SO-CALLED MADELUNG'S DEFORMITY OF THE WRIST (CARPUS VARUS AND CARPUS VALGUS)

With Particular Consideration of the Unusual, Reversed, or Backward Form of the Lesion

By DE WITT STETTEN, M. D., New York
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THE past year has witnessed a marked revival of interest in that peculiar deformity of the wrist, first clearly described by Madelung at the seventh German Surgical Congress in 1878, and since then more or less generally named after him. Quite recently a number of important contributions have appeared in the German, French, and Italian literature, but there still exists no very definite agreement either in regard to the etiology, the pathogenesis, or the treatment of the condition. These facts, coupled with the almost total disregard of the lesion by English and American authors, and the paucity and meagerness of references to the subject in the various text-books, have induced the writer to describe in detail the following remarkable case which represents an exact reversal of the usual type, and which he has already briefly reported in a preliminary communication elsewhere He is of the opinion that just because the case is atypical it is unusually illuminating, and throws considerable light upon the obscurity in which this so-called Madelung's deformity has hitherto been enveloped. The case is a most suitable one for study as it is an exceptionally well-marked example, as it exists in a youthful individual with distinct epiphyseal cartilages, and as it has been detected in the process of development.

Fig. 1.

Mary H. Aged 12 years. Schoolgirl. Born in the United States. Mother and father alive and well. Mother has had no miscarriages. There are two sisters and two brothers living, and in good health. One brother died at the age of four of cerebrospinal meningitis. There are no deformities nor history of rickets or syphilis in the family. The patient is the second child, of normal birth, and was nursed eighteen months. She began to walk at eighteen months, and had her first tooth at thirteen months. She had measles at three months, and convulsions for two hours and a gastroenteritis at five years of age. She has never had rickets, nor has she ever suffered from trauma previous to the development of her present condition. She has not engaged in any particular occupation which may account for her deformity.

A little over five months ago, the mother first noticed that the left wrist was deformed. This deformity progressed steadily to its present stage. There was no pain. After the deformity was first noticed, the patient fell and struck the palmar surface of the metacarpal region with the hand extended. The mother thinks that the deformity may have progressed more rapidly after this. Two weeks ago the mother observed a deformity on the right side similar to but less marked than that on the left, and accompanied by occasional slight pain. The patient does not complain of any disturbance in the range of motion of the wrist, nor in the power of the hands. She can also execute the finer movements of the fingers as in sewing or writing with ease and precision. Her chief complaint is the deformity of the wrists, particularly the left.

Examination. The child is well developed and well nourished, with good facial color. The visible mucous

Fig. 2.

Fig. 3.

membranes are pink; the teeth are in good condition; the faucial tonsils are hypertrophied; the thoracic and abdominal viscera and the organs of special sense are normal.

There are no parietal or frontal bosses. The contour of the thorax is normal, except for a very slight depression of the ensiform cartilage. There is no rosary nor Harrison's groove. There are no spinal curvatures. The left scapula is slightly more prominent than the right. The hips and knees are normal. The tibiæ are perfectly straight. There is a very slight weak foot on both sides, and an indication of cubitus valgus on the left. There are no enlargements of the epiphyses. The child's height is 120.5 cm. There are no sensory, trophic, or vaso-motor disturbances.

Both forearms, especially the left, are deformed, apparently at the wrist. This deformity is most noticeable in half pronation. Just above the joint there is a dorsal concavity on the ulnar side. At rest there is a decided adduction of the hand on the left side (140°), so that the extension of the axis of the middle finger strikes the radius just above its distal extremity instead of at the middle of the shaft as normally; but on the right side there is still very little deviation from the axis of the forearm. There is an apparent backward displacement of the wrist so that the hand lies on a plane dorsal to the forearm but parallel to it. On the volar surface the lower extremity of the ulna is prominent, while the two styloid processes of the radius and ulna are about at the same level. Looked at from the side, one is impressed with the resemblance of the condition to the so-called "silver-fork" deformity of a Colles' fracture. (Figs. 1, 2, 3, 4.)

On palpation one distinctly perceives that there is a bowing of the lower extremity of the radius with the concavity dorsally and toward the ulnar side, and the convexity anteriorly and laterally. This bowing has lifted the carpus backwards causing an apparent depression above the wrist, and leaving the lower extremity of the ulna protrude anteriorly. On the left side, particularly, the lower extremity of the ulna seems entirely free, being no longer in contact with either the radius or carpus. On this side the styloid process of the ulna is somewhat thickened. Especially on the right side, the ulnar end can be slightly reduced by pressure. When the right hand is markedly flexed the lower extremity of the ulna is seen to protrude a little dorsally. This does not occur on the left side. The extensor tendons are rather more prominent than normal.

Fig. 4.

MEASUREMENTS

	Right	Left
Normal for female of 129.5 cm. (after Testut)	17.4 cm.	18.5 cm.
Radius, from head of radius to styloid process of radius	14 "	13.5 "
Ulna, from olecranon to styloid process of ulna	16.5 "	16.5 "
Hand and forearm, from tip of fifth finger to olecranon	27.25 "	24.5 "
Hand, tip of middle finger to radiocarpal articulation	15.75 "	15.75 "
Circumference of wrist at styloid processes	13. "	13.5 "
Thickness of wrist	4.5 "	5.25 "
Breadth of wrist	3. "	3.5 "
Humerus, from acromion to external condyle	22.5 "	22.5 "

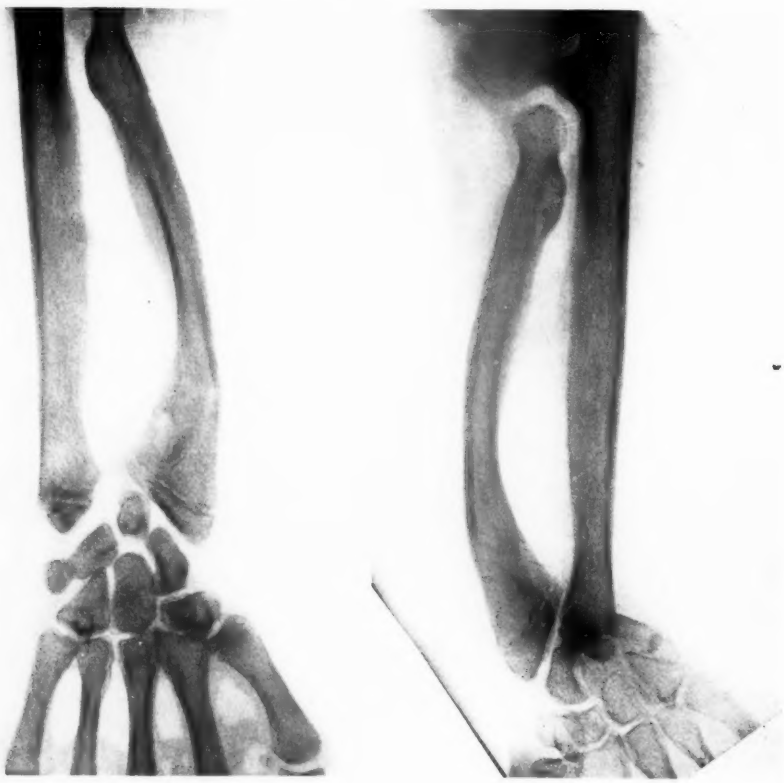
In other words, there is a decided shortening of the radius (3.5 to 4 cm.) a moderate diminution in the length of the ulna (2 cm.) and humerus (1.5 cm.), and an apparent displacement upward of the hand, especially left.

Motion is painless and is the same, active and passive.

At the wrist: The axis of the motions of flexion and extension, instead of being perpendicular to the forearm, is turned so that it runs from below and behind on the radial side anteriorly and upwards toward the ulna. On the left side extension and adduction are greatly increased, while flexion and abduction are much diminished, the last almost nil. Extension corrects the adduction of the hand. On the right side there is little change except that abduction is diminished.

	Right	Left	Normal
Extension	108°	70°	about 105°
Flexion	103°	132°	" 100°
Adduction	115°	82°	" 128°
Abduction	147°	165°	" 126°

It will be seen that the decrease in abduction and flexion is about compensated by the increase in adduction and extension respectively.



Right. Left.

Fig. 5. Anteroposterior exposure. Dorsum against plate. Hand in pronation.

Pronation is slightly impaired, especially on the left side, and supination is distinctly diminished, also mainly left, where it is no more than one third the normal, (circa 270°). The movements of the fingers are normal, and the child makes a good fist. There is no change in the mobility of the intercarpal joints. The power of the hand is fair, less on the left side.

The mother has rather prominent styloid processes of the ulna, dorsally, especially left. A six-months-old and a three-years-old sister show no abnormalities.

Radiographic examination[1] of the forearm discloses the following features, very much the same on both sides, but more marked on the left.

1. Anteroposterior exposure. Dorsum against plate. Hand in pronation. (Fig. 5.) The most striking peculiarity is the marked bowing of the lower half of the radius, most distinct at the lower third, with the concavity toward the ulna. There is an indication of a line of demarcation at this latter point where there is almost a definite angulation of the bone, at a distance of about 3.5 cm. from the styloid process. This bowing has turned the articular surface of the lower epiphysis in the same direction, so that it forms an angle of 90° left, 85° right, with a perpendicular to the axis of the upper half of the shaft, instead of the normal 25°. This deviation of the joint surface has placed the hand in adduction and has changed the arrangement of the first row of carpal bones. Instead of forming the gradual arch found in the normal wrist (Fig. 6), these bones form an acute angle with the semilunar at the apex. This bone seems to be forced as a wedge into the interosseous space, though both semilunar and scaphoid are apparently in normal relation with the articular surface of the radius, the profile of which is somewhat broader than normal. The lower end of the radius, particularly on the left side, has approached the ulna so that it appears either in contact with the latter, or even slightly overriding it. There seems also to be a slight rotation of the radius on its longitudinal axis — outward, as the interosseous ridge is somewhat more prominent than usual.

The lower epiphyseal line of the radius is a trifle irregular, although its width is normal, and its direction is in normal relation to that of the articular surface. There is nothing abnormal about the thickness of the epiphysis. The styloid process of the radius is just a few millimeters below that of the ulna.

There is an irregularity in the arrangement of the spongiosa with thinning of the corticalis, which involves both epiphysis and the lower extremity of the diaphysis. Near the center is a denser ridge, especially left, and toward the ulna is an irregular, more transparent zone, especially right. On the ulnar border of the left radius, just above the epiphyseal cartilage, is a small spinous projection, jutting downward and laterally, and strongly resembling an exostosis. The ulna is apparently normal, and there is no abnormality in either the development or ossification of the carpus, metacarpus, or phalanges.

There is no separate ossification center for the upper extremity of the radius. Measurements of the radiographic shadows of the bones give the following:

	Right	Left
Radius	13.5 cm.	13. cm.
Ulna	16.25 "	16.25 "

The bowing of the radius accounts for only .5 cm. of the shortening.

Fig. 6. Normal wrist of twelve-year-old child.

2. Lateral exposure. Radius against plate. Hand in extension and in semi-pronation. (Fig. 7.)

Here one is most struck with the decided bowing of the lower half of the radius, concavity backward. The articular surface of the lower epiphysis has been turned in the same direction, so that its extended plane forms an angle of about 150° with the axis of the upper half of the shaft, instead of the normal 80–90°, while the direction of the epiphyseal line is in normal relation to that of the joint surface. This deviation has carried the wrist backward, producing an apparent dislocation, and has left the ulna free on the anterior surface, so that there exists a true dislocation forward in both the lower radioulnar and triangular-cuneiform articulations, for it is obvious that the ulna has lost its entire relations to the joint.

The normal curve of the ulna with concavity forward is perhaps slightly exaggerated.

3. Posteroanterior exposure. Vola against plate. Hand in supination. (Fig. 8.) The bowing of the radius is much less marked, but the irregularity in the arrangement of the spongiosa is most decided, and the indicated line of demarcation is quite distinct at 3.5 cm. right, and 3.75 cm. left from the styloid process. The

[1] The writer wishes to acknowledge his indebtedness to Dr. E. W. Caldwell for the excellent skiagrams.

Right. Left.

Fig. 7. Lateral exposure. Radius against plate. Hand in extension and semi-pronation.

exostosis, left, is very definite, as is also the angulation of the first row of carpal bones.

Stereoscopic examination simply shows an accentuation of the above characteristics.

A comparison of my radiographs with others taken three months ago, and kindly placed at my disposal by Dr. M. S. Kakels, who saw the patient and presented her before the Metropolitan Medical Society at that time, shows a definite progression of all the features of the deformity. His pictures also show that the right side was already then very definitely affected.

We have here obviously to deal with a progressive curvature of the radius developing spontaneously in the period of growth, and showing the various characters which are generally conceded as typifying a Madelung deformity, but with the following differences:

1. The lower portion of the radius is bowed with its concavity backward instead of forward, and the joint surface is turned correspondingly.

2. There is an apparent posterior dislocation of the wrist instead of an anterior one.

3. There is a forward dislocation of the lower extremity of the ulna, in the lower radioulnar and in the triangular cuneiform articulations, instead of a backward one as in typical cases. (Cf. Figs. 1, 2, 3, 4, 7 with Figs. 9, 10.)

4. Extension is increased and flexion diminished, instead of the reverse.

On the other hand, the lateral bowing of the radius with concavity toward the ulna, the corresponding deviation of the articular surface in the same direction, the angulation of the first row of carpal bones, the position of the hand in adduction, and the increase in adduction and diminution of abduction, are the same as in the usual type.

But one other case resembling mine has been described. This was reported by Kirmisson in 1902. It is an almost exact duplicate of the one described above except that there were slight evidences of rickets.

The patient was a young girl of 13 years, and had a bilateral deformity of the forearms. There was no hereditary taint, the child had never had rickets, nor was there any history of trauma.

The disturbance began when she was 10½ years old and apparently in the best of health. The right wrist was easily fatigued and pained, especially on the ulnar side when she sewed or did such work as necessitated flexion of the wrist. Writing was not painful nor was any work in which the hand was extended or adducted, or, in other words, held in the direction of the deformity,

Right. Left.

Fig. 8. Posteroanterior. Vola against plate. Hand in supination.

Fig. 1. Fall 1.
Linke Hand, Ulnarseite.

Fig. 2. Fall 1.
Linke Hand, Radialseite.

Fig. 9. Typical example of the forward variety. Left hand seen from ulnar and radial side.

which began to make its appearance about this time. Five or six months later the same deformity with similar symptoms developed on the left side, but until shortly before she was seen by Kirmisson she was still able to use her hands.

The forearms are shortened and the hands are in a position of hyperextension and adduction. The lesion is most marked right. Measurements of the radius and ulna show these bones to be 3 cm. shorter than normal for the girl's size (after Testut's table). X-ray examination shows the shape of the ulna to be normal. The radius is markedly bowed in its inferior extremity with concavity backward and in the lower third with concavity toward the ulna. There is a deviation of the articular surface much more backwards and a little more inwards than normally.

The carpus is normally developed but is prominent dorsally, while the inferior extremity of the ulna projects anteriorly. The lower end of the ulna is dislocated forwards. The carpal bones are in normal relation with the articular surface of the wrist.

The axis of the motions of extension and flexion has become very oblique — upwards and inwards. Extension is increased, flexion is painful and diminished, abduction is impossible, while adduction is very much greater than normal. Supination is limited.

There is no muscular atrophy. The flexor tendons are somewhat thickened. There are no signs referable to the nervous system.

There is a distinct right dorsal scoliosis, with compensatory lumbar curvature. There is an abnormal curvature of the right ribs, producing a prominence of the right scapula. Anteriorly the lower costal regions are flattened, and the spinal borders of the scapulæ show a curvature with concavity inwards, so frequently found in scoliosis. There exists, then, a true scoliosis with osseous deformities, and not a simple postural curvature.

An osteotomy of the radius was performed, but simple linear division did not suffice. Owing to the extent of the bowing, it was necessary to resect 7 – 8 mm.

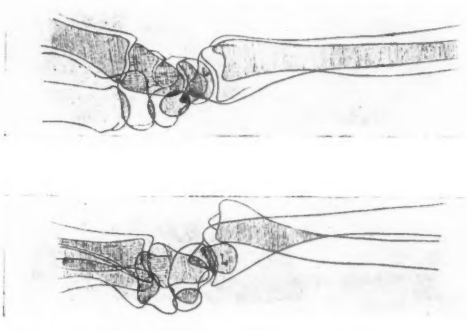


Fig. 10. Outlines of skiagrams. Radio-ulnar exposure. I, normal hand. II, hand from Fig. 9. L, semilunar bone. (After Siegrist.)

Fig. 11. Kirmisson's case.

of overriding bone. This was done, and exact coaptation obtained. The forearm was put in plaster, and the results were most satisfactory. To avoid recurrence the patient for some time wore a leather bracelet on each wrist.

I have taken the liberty to reproduce one of Kirmisson's illustrations (Fig. 11). Comparison with a photograph of my case with the forearms in the same position (Fig 1) shows the striking resemblance.

Kirmisson appreciates that his case is just the opposite of the usual state of affairs found in the classical Madelung deformity, of which he distinguishes two forms:

a. With simple turning of the articular surface.

b. With bowing of the shaft of the bone.

The latter form, of which his own case is a backward type, he thinks is due to a late rickets.

HISTORICAL REVIEW

Almost without exception the writers upon this subject, including Madelung himself, have accredited Dupuytren with the first reference to the condition. Some even (Schulze, Kölliker) have divided the honors between these two surgeons and bestowed upon the deformity the double patronymic of Dupuytren-Madelung. I have carefully examined Dupuytren's rights to this distinction and find them absolutely unsubstantiated. First, they are based upon a quotation, taken confessedly direct from Bégin; and, second, this reference concerns a class of cases which probably have nothing at all in common with the lesion which interests us, except that the hand was displaced forwards. In 1825 Bégin noted that among adult male workers in the cloth factories, particularly among printers and fullers who were engaged in continuous heavy work with press levers, a forward dislocation of the wrist occurred, with only very slight pain in the beginning, and with practically no functional disturbances, so that the patients rarely sought medical advice. He attributed the condition to a relaxation of the ligaments as a result of the occupation. This permits of greater excursions of the joint, and eventually a dislocation results. The deformity could be reduced by traction, but recurrence due to flexor contraction was the rule. In 1834 Dupuytren, just as noted, after quoting verbatim from Bégin, stated that he had seen a considerable number of such cases; and in 1841 the latter again referred to the subject by mentioning that he had seen a man with this lesion in the former's clinic. These cases of which we have no very definite data evidently belong to a form of professional deformity, and can in all likelihood be excluded from the group we are studying.

In 1835 Lesauvage described what he called a "luxation consécutive de l'articulation radiocarpienne" in a thirty-two-year-old soldier. This case has been accepted by Barthès and Siegrist as a Madelung deformity, but it was undoubtedly a pathological dislocation secondary to a traumatic arthritis.

In 1847 Smith reported two cases of apparently congenital origin, both of which bear some resemblance to the typical deformity. The first was a bilateral affection in a thirty-six-year-old female lunatic and epileptic. It consisted of a forward dislocation right, and a backward dislocation left. The anatomical investigation showed marked malformation of radius, ulna, carpus, and their various joint surfaces. The second case was forward and unilateral (right) in a young woman, and the autopsy showed a similar deformation. This latter case has been included by Siegrist in his table, but I consider both to be congenital anomalies and probably in no wise related to the type under consideration.

On the other hand, Cruveilhier, in 1829, dissected and described a right-sided forward dislocation of the wrist found in an adult female, with radius, ulna, and wrist considerably malformed, evidently from birth. This he at first regarded as a simple "luxation en arrière de l'avant-bras sur la main"; but he later admitted that it was probably a "luxation congénitale de l'articulation du poignet," while Dupuytren thought the deformity secondary to a fracture of the radius at the epiphyseal junction. Though the case bears a strong resemblance to the classical form the information given is too indefinite to warrant its acceptance.

In 1847 A. Nélaton referred very casually to an anatomical specimen examined by Boinet of a unilateral forward displacement of the

wrist without sign of fracture or injury. Malgaigne looked upon the case as a pathological dislocation and since Madelung's paper it has been considered as an example of the regular deformity. The reference is altogether too vague, however to justify its inclusion.

The first case that can legitimately be declared an instance of the lesion was reported by Malgaigne in 1855. It concerns a young boy of 11 - 12, a mason's apprentice who was engaged in carrying heavy weights. The deformity was unilateral, developed with pain in the course of eighteen months, and was seen by Malgaigne when the patient was thirty-six years old. There was an apparent irreducible forward displacement of the wrist, with a bowing forwards of the lower extremity of the radius and a deviation of the joint surface in the same direction. There was also an exostosis on the anterior surface of the radius just above the wrist. Only very moderate functional disability existed. A question might be raised that a fracture at the middle of the radius sustained some three years before the inception of the deformity may have borne some relation to its development. Malgaigne did not seem to think so, and classed it among the "luxations pathologiques," attributing it to a "simple relâchement des ligaments."

Weber in 1859 described a case of unilateral gradual deformation of the hand developing with pain in a young girl of sixteen. The wrist was displaced forwards, movements were painful, and extension very limited. He attempted reduction under anæsthesia which was possible, but the deformity recurred as soon as he released his pressure. He succeeded in maintaining reposition with an apparatus. Trauma and inflammation could positively be excluded, and he thought the dislocation due to muscular contraction.

In 1864 Busch referred to a similar case, but bilateral. There was marked dislocation forward. Pain on working and limitation of motion were the only symptoms. Reduction under narcosis being of no avail, he did a tenotomy of the tense flexor carpi ulnaris and palmaris longus tendons, but without success.

The first definite anatomical dissection was reported by Jean in 1875. There existed a bilateral forward displacement of the wrist, particularly on the right side. The subject was an old woman of seventy-three, but had had the deformity from childhood. The main features were a bowing of the lower extremity of the radius forward, and a dislocation backward of the lower extremity of the ulna, which was hypertrophied. The scaphoid and semilunar articulated with the radius by their posterior surfaces, as did the cuneiform with the triangular cartilage. There was a limitation of extension. Jean looked upon the condition as congenital and named it "double luxation congénitale complète du cubitus et incomplète du radius sur les os du carpe." The specimens were placed in the Musée Dupuytren where Delbet later examined them.

To Madelung belongs the great credit of first presenting a clear picture of the distinct clinical entity which, since his address before the Deutsche Gesellschaft für Chirurgie in 1878 on "Die spontane Subluxation der Hand nach vorne," has been more or less universally and deservedly known as Madelung's deformity. He described in some detail an anatomical dissection of a left-sided lesion found accidentally at the autopsy of a twenty-year-old woman. It had existed since childhood and the main features were an apparent forward subluxation of the wrist produced by the inclination of the articular surface of the radius toward the vola, due to a forward bowing of the axis of the radius at the epiphysis. It was noticeable that the dorsal edge of the lower extremity of the radius was free and prominent, while the palmar was atrophic. The lower end of the ulna was very prominent dorsally.

After a fairly detailed reference to five other cases, and a statement that he had seen at least twelve altogether, he summarized the situation about as follows: The condition is a form of disturbance of growth in the joints as described by R. Volkmann and analogous to pes valgus, genu valgum, and scoliosis. It develops spontaneously, never before thirteen, and rarely after twenty-three, with pain and limitation in the extension of the hand. Flexion may be increased while the restriction of adduction and abduction varies. The affection is usually unilateral, and twice as frequent in women as in men. The patients generally belong to the working classes, and

the deformity usually reaches its height in from one to two years. The main factor in its formation is the more powerful action of the flexors of the forearm due to over-exertion. Continued hyperflection stretches the extensor tendons and the posterior ligaments over the dorsum of the radial epiphysis, exerting a forward force and producing a volar bowing. Pressure of the carpus on the anterior edge of the lower extremity of the radius causes atrophy, while the release of pressure from the posterior edge permits of hypertrophic growth. The disease is one of the growth period, and requires as a predisposing factor a primary weakness of the bones or a disturbance of nutrition such as that due to disuse. Treatment should be palliative, especially the sparing of the deformed extremity particularly in the sense of extension, exercise, and the use of the leather band around the wrist. Manus valga would be an appropriate name.

In the discussion of Madelung's paper, Czerny, Hirschberg and von Langenbeck took part. The first claimed to have seen two cases, of which one was undoubtedly an arrested growth at the epiphyseal line, secondary probably to an epiphyseal separation or a fracture involving the cartilage. The second had seen two mild cases in young women, pianists. He thought with von Langenbeck that the condition is due to a relaxation of the ligaments. The latter had seen similar cases, and objected to the term manus valga as it had already been used for the reverse of the usual form of club-hand or manus vara.

In 1880 Pooley, evidently unaware of Madelung's report, described a very characteristic case of the deformity under the caption of "Congenital Dislocation of the Wrists."

Félix, inspired by Tripier, published a thesis in 1884 in which he described a bilateral case in a young laundress. He entitled the disturbance as had Madelung — la subluxation spontanée du poignet en avant; but suggested a somewhat different explanation. He considered a strain of the joint in the growth period a contributary cause which resulted in a hyperexcitability of the spinal cord, producing:

1. Nutritional disturbances in the articulation.

2. Muscular contracture, a gradual malformation and a secondary subluxation.

A most important contribution on the subject appeared in 1885 by Duplay. He reported a unilateral case of "courbure rachitique de l'extrémité inférieure du radius" in a young girl, and emphasized the fact that the apparent forward subluxation of the wrist is the result, primarily, of a volar curvature of the lower end of the radius due to a late rickets, and resembles, etiologically and pathogenetically, the genu valgum of adolescents, which had been so carefully investigated in 1879 by Mikulicz. He noted also the hyperostosis of the backward dislocated lower end of the ulna, and finally advocated a linear osteotomy of the radius, which he performed very successfully, as the rational treatment. Six years later (1891), he reported a second similar case, and referred to a third which he had seen. He now calls the condition "rachitisme tardif des poignets."

In the meanwhile (1888), von Bergmann put a typical case on record, and confessed to be in doubt as to the cause. He was certain, however, that it is a disease of the growth period resembling the so-called inflammatory flat-foot of youth, and suggested that it may be a disturbance of development in anæmic and weakened individuals.

Hoffa, in the first edition of his "Lehrbuch" (1891) referred to a case which he had under treatment, and for which he had constructed a special orthopædic apparatus. In the last edition (1905), he spoke of having seen several cases, but aside from a republication of his original pictures and a skiagram, he gave no details.

Bode, in 1891, added another case to the list. He called it "Spontanluxation der Hand," and considered it a central disturbance of a trophic nature, due to relaxation of the ligaments and irregular cartilaginous growth.

A most interesting observation appeared in 1892, by Guépin. He presented before the Société de Biologie a young woman with a typical bilateral deformity existing since childhood, and with distinct hereditary factors. The The father had large wrists; the mother had the same deformity as the daughter, but more marked; sisters and brothers of the mother also showed the same lesion; and nine sisters and

brothers of the patient, and the children of a sister all had prominent ulnæ from childhood. Guépin looked upon the condition as a family disease, and considered a congenital laxity of the ligaments the ultimate cause. He named the deformity "laxité congénitale de l'articulation radiocubitale inférieure et subluxation consécutive de la tête du cubitus en arrière." He further noted that he had seen the same deformity in an externe at the hospital.

A significant suggestion came from Redard in the same year, together with a very carefully analyzed case. A young washwoman showed a bilateral deformity with bowing of both radii and ulnæ. He had the idea that the disease is due to a disturbance of growth of the epiphyseal cartilage. Continuous irritation as from some particular kind of work produces a functional hyperactivity of certain portions of the cartilage with the formation of bony hypertrophies and secondary subluxation of the wrist.

In an inaugural dissertation in 1894 Malfuson described two important instances occurring in mother and daughter, both bilateral and with bowing of the radii. He looked upon the deformity as a typical one, due to a disturbance of growth and function of both bones of the forearm, and probably on a rachitic basis. He favored, as did Redard, Duplay's osteotomy of the radius, should palliative treatment be of no avail, and should the functional disturbances demand radical treatment.

A most interesting though indefinite report was published by Féré in 1896. He first claims to have seen a mother and two daughters with the deformity, and then to have observed twenty-five cases among one hundred and forty-eight adult male epileptics, as against four in fifty old men. The end of the ulna was hypertrophied and dislocated backwards. He reproduces photographs of two cases, and states that in twenty-three of the twenty-five epilepsy cases the deformity was unilateral. He looks upon it as a disturbance of development with a hereditary predisposing cause and independent of external influence. An associated laxity of the ligaments, so frequently inherited, as Robert has shown, may also be a contributory factor.

As upon many other dark places in medicine and surgery, the Röntgen rays threw their marvellous light upon this puzzling subject, and after their discovery, practically all the cases were subjected to radiographic examination; most of the pictures are reproduced and the majority of the authors lay the main stress on the radial curvature. The credit of first investigating the problem by means of the X-ray belongs to Jagot (1897). He examined a characteristic case in a young milkmaid, and found a bowing forward of the radius with hypertrophy of the lower end of the backward dislocated ulna. There was a distinct hereditary tendency, the father, uncle, and grandfather having very much thickened wrists, but without subluxation or functional disturbances. He classed the lesion among the teratological anomalies dependent upon nutritional irregularities, heredity, etc., and called it a "vice héréditaire de conformation des deux poignets."

Ch. Nélaton in 1897, writing in Duplay and Reclus' system, referred to an anatomical specimen in the Musée Dupuytren which he considered an example of late rickets, which he had first thought to be a deformity after fracture, and which unquestionably is a spontaneous bowing of the radius belonging to our group.

The following year (1898) brought forth a contribution from Kirmisson's clinic by Guéry with a new case in which there was apparently only a deviation forward of the articular surface of the radius. He regards the disturbance as one of the growth period analogous to genu valgum, etc., and depending upon:

1. Constitutional weakness of the ligaments.
2. Overwork.
3. Influence of growth.

With Kirmisson he suggested the name "subluxation progressive du poignet chez les adolescents."

In 1899 Delbet published a most instructive clinical discourse delivered two years previously at the Hôtel Dieu, on "carpus curvus." A detailed report of a new case which was treated by osteotomy is given, and five others — three bilateral, and all in women, of which the author has plaster casts, are referred to. He further carefully examined the specimens in the Musée Dupuytren which Jean had described in 1875, and found these to be typical examples. His conclusions are as follows:

1. The deformity is due to an abnormal curvature of the radius.

2. The scaphoid and semilunar bones are neither dislocated nor subluxated, but retain their normal relation to the radial articular surface, which, however, has changed its direction.

3. There is a secondary dislocation of the ulnar-triangular-cuneiform articulation, with more or less disturbance in the position and integrity of the triangular cartilage.

4. In advanced cases one can obtain a satisfactory correction of the deformity by osteotomy of the lower end of the radius. He demonstrated the rationale of this, experimentally, on one of the museum specimens.

5. The disease is an irregular development of the epiphyseal cartilage, related to the cartilaginous exostoses, analogous to genu valgum, and most probably caused by a late rickets in connection with the predominating action of the flexors. One might distinguish an acute from a chronic form; also an early from a late type.

In the same year Cabeça contributed another case report, with the usual features, and advised osteotomy. He accepts either the name proposed by Madelung or that proposed by Delbet.

During this year also, several valuable additions to the literature of the subject were offered by the Lyons school. Gangolphe presented two carefully studied bilateral cases in mother and daughter, with not only forward but also inward bowing of the radius. He rejected the term subluxation, accepted Destot's suggestion of "radius curvus" as the most satisfactory nomenclature, and believed the deformity due to the flexor action exerting a greater pressure on the anterior half of the epiphyseal cartilage which prevents growth and allows the posterior half to develop. He thought the condition independent of rickets, and agreed that osteotomy is the rational therapeutic step, if an apparatus and tenotomy are unsuccessful. Destot who reported on the radiographs of Gangolphe's cases thinks the condition an exaggeration of the normal curves of the radius due to a disease of the epiphyseal cartilage.

In the discussion of Gangolphe's paper Bérard gives the results of a dissection with Delore, and agrees with the former as to etiology and treatment. Ollier claims to have seen many cases. Forchier recommends resection, or partial resection, of the lower end of the radius; and Nové-Josserand suggests that a latent heredity becoming potent when the hands are first actively used may be the cause of the deformity.

Basing his study upon the two cases of his teacher Gangolphe, Roget wrote a thesis for the doctorate and added one new case — with definite heredity. He also mentioned a dissection of two specimens by Destot in Ollier's laboratory, and an indefinite case which Destot had seen. His conclusions are practically those of Gangolphe. He advocates a cuneiform osteotomy of the radius at the end of the growth period.

Another instance of heredity was noted by Dekeyser in 1901, who described two typical unilateral cases in mother and daughter, and who realized the role played by the curvature of the radius. He thought the shortening of the ulna plays a part, and accepted Guéry's proposal as to the predisposing factors, and believed that the actual cause is a disturbance of growth of the bones. He entitled his paper, "Subluxation spontanée du poignet."

The next year Kirmisson submitted the report of the reversed type of the deformity, which I have quoted *in extenso* above. He likewise suggested the two divisions to which I have also referred, putting Madelung's and Guéry's cases in the former, and Duplay's, Delbet's, and his own in the latter class. Though he favors the rachitis tarda theory, he hints, as does Delbet, at an arrested development related to exostosis formation to which Bessel-Hagen so emphatically called attention.

The same year (1902) articles appeared by Gevaert and Ardouin, each with a new case history. The former accepts Kirmisson's nomenclature, his rachitis hypothesis, and likewise his subdivisions, drawing the line even a trifle more sharply. The latter regards the lesion as congenital, and calls it "luxation congénitale incomplète du poignet."

An exceptionally carefully written paper was published in 1903 by Abadie, from Forgue's clinic. After describing a new case, possibly of traumatic origin, he submits an historical analysis of the subject with a tabulated review

of almost all the cases reported up to date. He classifies as follows:

1. The radius preserves its relations with the wrist.

(With or without bony lesions of radius or ulna.)

a. With displacement of the ulna backward. (All cases except Kirmisson's.)

b. With displacement of the ulna forward. (Kirmisson.)

2. The radius loses its relations with the wrist, and is dislocated (?).

(Without bony lesions.)

[Dupuytren (?), Bégin (?), Boinet (?), and Guépin (?).]

Abadie further claims that the deformity need not necessarily be the result of one particular, but may be the result of a variety of lesions. Based upon the anatomical study and the clinical course, he distinguishes the following groups:

a. Hyperostosis of the ulna, always bilateral, appearing in childhood or even congenital; a bony malformation which may terminate simply by producing a large wrist, or which may be the starting point of a progressive dislocation, and which may often be overlooked.

b. Simple subluxation of the ulna on both radius and carpus, with ligamentous relaxation, easily reduced with "touche de piano," bilateral, often without pain, and secondary to *a*, or actually the first stage of a subluxation of adolescence.

c. Displacement of the ulna with deviation of the articular surface of the radius, reduced with difficulty, or irreducible.

d. Bowing of the radius. The last two are frequently unilateral, and represent the usual clinical course.

In other words, while *a* is not typical of a Madelung's deformity, it represents a predisposition thereto; *b* are the borderline cases; and *c* and *d* the characteristic ones.

Late rickets will explain the majority of the cases, but for his own Abadie suggests as a possible explanation an injury to the lower end of the radius (epiphyseal separation), with secondary disturbance of the growth of both bones.

The same year (1903), Cnopf placed another case on record, recognized the bowing of the radius as an essential factor, but added little new to the discussion.

In this year also Wittek called attention to the fact that a fracture of the volar edge of the lower joint surface of the radius could simulate very closely a typical Madelung deformity.

Bennecke in 1904 presented a young girl at the German Surgical Congress who had been carrying heavy weights with the hands in extension, and who had developed a bilateral deformity. There was a bowing of the radii, and the first row of carpal bones showed a wedge-shaped arrangement. Bennecke considered continuous trauma the cause of the disease. In his case dorsal flexion causing pressure against the anterior half of the articular surface of the radius had caused an atrophy of the bone and a displacement forward of the wrist. He appreciates that this is usually the result of volar flexion, but he maintains that the opposite motion can produce the same effect. The projecting ends of the bone might be resected if there is sufficient indication.

In an inaugural thesis in 1904, Barthès described two forms of the deformation:

a. Progressive dislocation of the wrist in youth; and

b. In adults.

The former type is the regular Madelung deformity due to a bowing of the radius, and is usually painless; the latter is a regular subluxation due to arthritis, muscular contraction, trauma, etc. Two new cases of the second type are submitted. One is in all likelihood dependent upon an exuberant callus after a fracture of the scaphoid, and does certainly not belong to the classical picture; while the other seems to be the result of a hysterical contracture, and is also, in all probability, in no way related to a Madelung deformity.

In the same year Poulsen also reported two cases, and submitted the following conclusions:

1. Madelung's deformity depends upon a curvature of the radius towards the vola and sometimes towards the ulna, due possibly to a rarefying osteitis.

2. In some cases there is only a slight bowing of the entire bone, while in others there exists at the same time, a marked bend of the lower third.

3. The carpus is normally connected with the joint surface of the radius.

4. There is a secondary backward dislocation of the ulna from the radius and cuneiform.

5. Osteotomy of the radius is the only way of correcting the deformity — oblique linear is preferable.

The next year (1905) witnessed several contributions. Leclerc presented a case of Albertin's before the Société de Chirurgie de Lyon. He accepts Gangolphe's terminology, "radius curvus," but believes rickets to be the cause, with trauma as a possible exciting factor.

Schulze described another example under the title of "Spontane Subluxation der Hand nach unten, (Dupuytren-Madelungsche Subluxation)," while Th. Volkmann reported two more, in one of which he noted, as did Gangolphe, Bérard, and Poulsen before him, and as do most of the observers after him, a second curvature of the radius towards the ulna. He names the deformity "Madelungsche Subluxation nach vorne," and offers the suggestive opinion that it is a primary disease of the radius, possibly rickets, which leads to weakness of this bone and bowing on account of the flexor pull, either at the epiphyseal line or higher up on the shaft, according to the seat of the pathological changes.

Three Norwegian cases were put on record about this time, all males. The first was described in 1905 by Natvig who accepted Poulsen's conclusions and the other two, in brothers, were reported the next year by Solberg.

An excellent review appeared in 1906 by Gasne. Though not contributing any new material, he emphasized the distinction of Kirmisson and Gevaert, dividing the cases into:

1. Madelung's subluxation ("subluxation du poignet.")

2. Radius curvus:

a. Ulna displaced backward.

b. Ulna displaced forward.

The cases in group 1 are produced by overwork, and belong to the occupation deformities; while those under 2 are due to a late rickets.

The same year Piollet enriched the statistics with another very carefully reported observation, advocating as treatment cuneiform osteotomy.

Another clinical report appeared by Schade under the title "Luxation im Handgelenk auf Grund pathologischer Zustände," probably rickets.

In this year also an exceptionally thorough X-ray study of an instance of the disease was made by Putti. He considers it a professional deformity caused by continuous dorsal flexion (see Bennecke), which results in an irregularity of growth of the epiphyseal cartilage.

Three observations were furnished the same year by Sauer. He decides that the deformity is a complete dislocation of the wrist in the ulnarcarpal joint and of the radius in the lower radioulnar articulation. Exceptionally, a radiocarpal subluxation can occur. A bowing of the radius, most likely of rachitic origin, is the pathological basis for these changes.

A traumatic case is also included in his article, but merely to show that fracture can simulate the deformity (see Barthès). He advises the use of the term manus valga.

An interesting contribution came also in 1906 from Depage. His patient, whom he had previously shown at a meeting of the Société Clinique *des* Hôpitaux de Bruxelles, presented externally a characteristic deformity. but the skiagraphic examination revealed no bowing of the radius, but only a unilateral atrophy of all the bones of the forearm and wrist. He considers the trouble an osseous dystrophy (as Félix), possibly on the basis of an infectious (measles) myelitis, causing a mild destruction and resorption of the bone. Although he excludes tuberculosis and lues, it appears to me more than likely that some chronic inflammation lies at the bottom of his case, or it may possibly be an example of a caries sicca, as is found occasionally in the shoulder-joint. At any rate, his case is no typical Madelung deformity. Depage divides the cases into four groups:

1. Bilateral, professional deformity due to relaxed ligaments (Dupuytren).

2. Symmetrical hypertrophic growth of the inferior extremity of the ulna (Féré).

3. Bilateral rachitic curvature of the radius (Duplay, Delbet, Kirmisson).

4. Occupation deformity with erosion of the

anterior half of the inferior articular extremity of the radius (Madelung).

These divisions correspond practically to Abadie's, (1=*b*; 2=*a*; 3=*d*; 4=*c*), though the latter more rationally realizes that there can be no sharp lines drawn, and that one group is often but a difference in degree of the other.

In 1907 Stieda and Lénormant each published a new case, while Pels-Leusden contributed two more examples, one of which he had already presented at a meeting of the Freie Vereinigung der Chirurgen Berlins. He assumed, as did Redard, that there is a disease of the intermediary cartilage which causes a premature ossification of the ulnar and volar side with a change of longitudinal growth. This is increased by the pull of the flexors (Gangolphe, etc.). The condition is related to the multiple cartilaginous exostoses (Kirmisson, Bessel-Hagen), indications of which were found in his cases.

A suggestive contribution came in the same year from Ewald, who showed that an impacted fracture at the epiphyseal junction could simulate the deformity, and concluded that the classical picture is due to a sudden or continued trauma, or a pathological process acting at this point.

In the latter half of 1907 and the beginning of this year three very notable articles appeared by Estor, Siegrist, and Franke, all with a fairly complete review of the previous literature, together with moderately accurate bibliographic references.

Estor, after describing a characteristic case in a young woman, who has had the deformity since she remembers, and whose father has the same disturbance, comes to the following unusual conclusions, in spite of realizing that a curvature of the radius is an essential of the disease:

1. Madelung's deformity consists in a congenital laxity of the inferior radioulnar articulation, and is an exaggeration of a normal tendency.

2. It appears sometimes in earliest childhood without exciting cause, sometimes during an apprenticeship from professional overexertion, and sometimes as the result of a slight accidental trauma.

3. In those cases where it produces a functional impotence, surgical intervention is indicated, and as the deformity involves mainly the ulna, it is advisable to practise osteotomy of this bone rather than of the radius. He favors the term "subluxation congénitale du poignet."

Siegrist, in a very lucid essay from de Quervain's X-ray laboratory, which probably represents the most painstaking work that has yet been done on the subject, describes in detail three cases, all showing a distinct hereditary influence, refers to two other mild examples that he saw after the completion of his paper, and finally records a case of arthritis deformans of the wrist in which a Madelung deformity was imitated. His conclusions are that the salient feature is a turning of the articular surface of the radius due to either or to both a bowing of the shaft or an irregular growth of the epiphyseal line with a displacement of the epiphysis; and that this is induced by the predominance of the flexor action acting upon a bone probably affected with late rickets. Hereditary predisposition and occupation also play a contributory role. There is further an ulnar turning of the joint surface due to a bowing of the diaphysis, and an irregular growth of the epiphysis, more on the radial and less on the ulnar side. The ulna end remains displaced backward in a passive way and generally hypertrophies and curves backwards owing to the lessened resistance. The displacement of the wrist forwards results naturally, as does the wedge-shaped formation of the first row of carpal bones, but an actual radiocarpal dislocation does not occur. Siegrist attempts no explanation of Kirmisson's case. He is not an enthusiast for osteotomy, as he claims it has only cosmetic value, and favors an orthpædic apparatus applied in the developmental stages. He again proposes the name originally suggested by Madelung — manus valga.

Franke(1908) gives us the most carefully recorded and most minutely described anatomical and radiographic study of a specimen which Müller presented the previous year at the Naturforscher Versammlung. It is an undoubted instance of the classical deformity, though it shows some variations from the vast majority of the cases. There are very marked evidences of a previous rickets, there are multiple exostoses, and the main lesion

is in the epiphysis. Franke concludes that, while the generally accepted view that there is no real radiocarpal subluxation is correct, and that the displacement is due to a deviation of the lower articular surface of the radius this is the result not of a curvature of the shaft of the bone but of a disturbance in the direction of growth with bowing of the epiphysis itself, and should there be a curving of the diaphysis, this is secondary, and in no causative relation to the disease. This opinion is more in accord with Madelung's original idea. The pathological change is attributed to a growth disturbance of the epiphyseal cartilage, probably rachitic.

In the early part of this year also, I find the first direct American record, a presentation by Brinsmade of a typical case before the New York Surgical Society. He favors Pels-Leusden's interpretation.

As late as 1907, however, Peckham in this country described a case which he termed "congenital deformity of the wrist joints," which, according to the photographs and radiograms, I take to be a typical Madelung, and which was supposed to be cured by freeing and reducing the dislocated ends of the ulnae.

For the sake of completeness I wish also to mention a reference by Painter in Bryant and Buck's new system (1908). Under the title "Congenital Dislocation of the Carpus," he reports a disability of the left wrist in which the X-ray showed an inclination of the ulna toward the radius. A good result was obtained from osteotomy of both bones. Although Painter is inclined to look upon this case as an example of a Madelung deformity, it bears few of the landmarks of this lesion.

Since there have been numerous discrepencies in the hitherto published statistical details, I have carefully prepared the following abstract of cases, attempting to avoid repetition by omitting those facts referred to in the historical review. One finds considerable difficulty in knowing just which cases one should incorporate; and one also sees that there is scope for considerable difference of individual opinion, as the following published totals show: Abadie, 75; Estor, 85; Siegrist, 58; Franke, 56. In all these lists, while numerous reported cases have been left out, many have been included which do not properly belong there, and in my tabulation I have rigidly rejected all cases where:

1. There was a reasonable doubt as to the actual existence of a typical Madelung's deformity, and a probability that the condition was some other pathological lesion.

2. The deformity was of such a slight degree as could scarcely be considered abnormal.

3. The description was too vague or the reference too indefinite to justify inclusion.

PATHOLOGY

Our knowledge, then, of Madelung's deformity is based upon sixty-four comparatively authentic observations, all more or less carefully described cases and well-marked examples. Of this number sixty-two are of the forward and two are of the backward variety. Five cases have been examined anatomically, and thirty-six radiographically. No histological examinations have been made.

It is obvious that the disease is essentially one of the osseous system, and as three distinct parts of the skeleton are involved, I shall consider each independently.

1. The radius. Without a doubt, the significant pathological lesion of a Madelung deformity concerns the radius, and consists primarily in a deviation of the inferior articular surface on a transverse axis toward the vola in the anterior form, and toward the dorsum in the posterior group. This change of direction varies in degree from a very slight turning to one so great that the articular surface, instead of being nearly perpendicular, anteroposteriorly, to an ideal axis of the shaft, is almost parallel to it, as in Franke's case.

In forty-seven of the cases it is distinctly noted that there was a curvature of the bone. In twenty it is specified that the lower extremity was curved; in two, the lower fourth; in five, the lower third; in three, the lower half; in one, the lower two-thirds; and in four, the entire bone. In twelve the actual location of the bend is not indicated.

In those cases where the bowing involves only the lower extremity, it is usually most marked in the neighborhood of the epiphyseal line, so that it is mainly the epiphysis itself which is bent. Once it is definitely stated that

the bend is at the epiphyseal line (Sauer); and twice it is apparent that the epiphysis only is concerned in the curvature (Madelung, Franke). Of the other cases, once where the lower half is bowed, the curvature is most marked at the epiphyseal junction (Sauer), and three times where the lower half, two-thirds, or entire bone is curved, a sharper bend of the lower end is particularly referred to (Cnopf, Poulsen, Siegrist).

Of the seventeen cases where a radial bending is not noted, fifteen were either observed before the radiographic era, or were not X-rayed, and none were anatomically examined, so that there are really no definite data as to the form of the bone. Only two were radiographed. In one (Guéry) a change in direction of the articular surface existed, which fact really signifies a bowing of the epiphysis as in Madelung's and Franke's cases; and in the other (Sauer) the deformity is attributed to a broad, irregular epiphyseal cartilage associated with which there was probably a turning of the entire epiphysis. It is evident, then, that this change of direction of the articular surface, forwards or backwards, is due to a curvature of the radius in an anteroposterior plane. As a rule, mainly the lower extremity is involved, but the location of the bend may vary. In most of the examples, this bowing begins proximal but near to the epiphyseal line, or, in other words, in the shaft proper, and ceases at the junction. In a few only the bone distal to the epiphyseal cartilage seems affected, and in some both diaphysis and epiphysis take part in the curvature. Finally, in one case the cartilage itself seems diseased (Sauer), while in three persistence or irregularity of the cartilage accompanies the bony lesion and apparently exaggerates it (Lénormant, Pels-Leusden, Franke). I see absolutely no need for the subdivision of Kirmisson and others into simple deviation of the joint surface and curvature of the shaft. There is an almost invariable involvement of the shaft with merely a variation in degree and location, and an occasional abnormality of the epiphysis. The only classification I believe advisable is into a forward and a backward variety.

Since the cases have been subjected to X-ray examination, a large percentage (twenty-one out of the last thirty-nine) have also shown a curvature of the radius on a lateral plane, always with the concavity toward the ulna — an exaggeration of the normal curve of the bone. This second bowing usually corresponds in site and extent to the anteroposterior curvature (fifteen cases), and was noted in the lower extremity or lower third, ten times; in the lower half, especially at the epiphysis, once; in the entire bone, particularly at the distal extremity, twice; and not specified, once. The location or degree of the curvature toward the ulna differs somewhat from that in the dorsovolar plane in seven of the cases, as follows: Lower two-thirds volar concavity with sharp bend forward and inward at lower end (Cnopf); bone bent forward and slightly inward (Estor); entire bone bent forward, and at epiphysis toward ulna (Siegrist); bowed at middle toward ulna and at lower extremity forward (Franke and Brinsmade); inferior extremity bowed backward, and lower third bowed inward (Kirmisson); and my own case in which the lower half of the bone was bowed backward and toward the ulna, with the latter bowing much more acute at the lower third.

This curving of the bone inward, involving shaft or epiphysis or both, produces a turning of the joint surface on an anteroposterior axis toward the ulna, which varies from a slight exaggeration of the normal inclination (about 25°) to so great a divergence that the articular surface in the dorsovolar aspect runs practically parallel to the normal shaft, as in my case.

A shortening of the radius has also been frequently noted (seventeen times) which can generally, but not always be accounted for by the curvature. This shortening varies from one to ten centimetres (Abadie). Usually the most markedly curved side is the shorter one, but Pels-Leusden has noted that even when the bowing is the same one side may be shorter than the other.

Changes in the articular surface itself are not uncommon, and consist in irregularities or excavations, (Poulsen, Franke). Occasionally, there is an hypertrophy of the dorsal and an atrophy of the volar edge in the forward cases. (Weber, Busch, Madelung, Schulze, Bennecke, Franke).

As a coexistent lesion of the radius, exostoses near the epiphyseal line have been remarkably frequent. They were found in nine cases.

Rarely changes in the superior extremity of the radius (arrested development, Lénormant), or in the upper part of the shaft (slight curvature in opposite direction, Cnopf) exist, but they are not significant.

2. The ulna. The ulna plays a more passive role in the development of the deformity. The caput ulnae simply remains displaced backward or forward, and in the severer cases is actually dislocated in the lower radioulnar articulation. Occasionally the normal forward bowing is slightly exaggerated in both types (four times), while sometimes in the forward form the ulna is turned backward (three times). Twice there was a slight bowing toward the radius.

There is frequently a hyperostosis of the lower end (eleven times), and the whole bone is generally as long as or longer than normal. At times, however, it participates in the general arrest of growth, and remains somewhat shortened, but rarely as much as the radius (twelve times).

3. The wrist and hand. As a natural consequence of the displacement of the main articular surface for the carpus, the latter follows the deviation and is displaced in the same direction, either forwards or backwards, but upon a plane parallel to the forearm and toward the ulna (adduction). Sometimes the wrist is also displaced a trifle upwards. Rarely the hand is abducted (Abadie, Poulsen). As a rule, the relations between scaphoid and semilunar and radius are practically normal, but in extreme cases the wrist bones slide somewhat on the articulation in the direction of the deformity. On the other hand, the cuneiform usually loses its connection with the triangular cartilage, and there is often a true dislocation in this joint.

The arrangement of the first row of carpal bones undergoes a characteristic change. Instead of the normal gradual arch which these bones form, an angular, wedge-shaped grouping develops, due to the ulnar deviation of the joint surface. The semilunar is at the apex of this wedge and appears to be forced into the interosseous interval. The second row of the carpus may be extended upon the first in forward cases, a purely compensatory condition. Slight irregularities of the carpal bones themselves have been noticed (Bérard, Estor).

The ligaments are naturally stretched, and the triangular cartilage is likely to be disturbed, but we have no very precise data on these points.

Occasionally there are some secondary changes in the synovia of the radio-carpal and carpal joints (Bérard).

There is never a local muscular atrophy. In the forward type the flexor tendons frequently stand out as prominent cords.

A most striking feature of this disease is that it is very frequently bilateral (forty-three times: equal on both sides, eighteen; more marked right, fifteen; and more marked left, ten times). The disease was unilateral twenty times (seven, right; eleven, left; and twice not specified). Once it is not stated whether one or both sides were affected. In other words, the deformity is twice as frequently bilateral as unilateral. When both sides are involved, one side usually becomes deformed before the other.

ETIOLOGY AND PATHOGENESIS

On examining our table for predisposing factors, we are at once struck with the remarkable fact that of the sixty-four cases, fifty-five were females, only eight were males, and in one the sex was not specified. The deformity is, then, seven times as frequent in females as in males, and we have here simply another example of sex acting as a contributory factor in the development of a disease.

As to the age at which the deformity begins, this is stated or implied in fifty-eight cases. With the exception of Estor's case, where it is claimed that the deformity existed from birth, the youngest age definitely noted at which the deformity began, is before eight, and the oldest eighteen. I have estimated the average age, and find it about twelve years, with "childhood" calculated as ten. I assume further that, in the majority of cases, at least one year has elapsed between the inception of the disease and its discovery. Although with Estor, five other observers, Jean, Pooley, Guéry, Ardouin, and Peckham look upon the condition as congenital, there is little evidence in favor of this

view, and these last even admit that the deformity was only first noticed in early childhood.

It is obvious from the above that the disease is one of the growing years, usually of the so-called second growth period when, as Vogt has noted, there is an increase of the nutritional and growth processes. This period begins with the second dentition (at about seven years), and there exists at this time, as the frequency of osteomyelitis and other inflammatory conditions near the ossification centers tend to show, a lessened resistance in these locations. The same is true in the third period or the beginning of puberty (about twelve to fourteen years), when the deformity may occasionally develop.

In no case can acute or chronic inflammatory processes be held responsible for the trouble, and although numerous attempts have been made to find a previous traumatism as a cause of the deformity, in but one case (Abadie) does there seem to be any significance to this trauma or any connection between it and the lesion, though it is generally recognized that an injury may produce an arrest of growth at the epiphyseal junction which may simulate the deformity. The disease is evidently one which develops independently of any sudden traumatic influence, as the very fact of its being generally bilateral, and in young girls who are so little exposed, presupposes. As is well known and natural, traumatic osseous and articular lesions are vastly more frequent in males of about twenty years of age.

Nor does the occupation of the individual seem to play any part whatsoever in the etiology of the condition. This is quite logical, as it affects mainly young girls, who usually are either too young to work at all, or whose work is of so light a nature that it could have little deleterious effect.

Neither does it seem that the social status of the patient has any relation to the formation of a radial curvature. To be sure, the majority of the children belong to the peasant or working classes, who are more or less poverty-stricken, and it is possible that this has an effect upon the general nutrition. The fact in itself, however, that most of the patients belong to the poorer families is easily explained as it is this class which supplies the hospital and clinical material upon which most of the scientific publications are based.

The general condition of the patient likewise seems to have nothing whatever to do with the local deformity, for although an occasional case existed in a weakly developed individual, the majority of the children were either otherwise comparatively normal, or even sturdy.

On the other hand, heredity plays a most important part in determining a predisposition. In our list there are twelve distinct instances of heredity, embracing twenty cases, or almost one-third of the entire number. The frequent bilaterality of the lesion favors this view as a large proportion of hereditary or congenital affections are symmetrical.

I wish here to emphasize the distinction between hereditary and congenital. While, as I have pointed out above, there is no evidence in favor of looking upon the deformity as one existing from birth, there are decided reasons for believing that the disease may be a family one, a tendency to its development being often transmitted from generation to generation and becoming active during a certain period of life. A similar state of affairs is frequently noticed in many pathological conditions (diabetes mellitus, gout, arthritis deformans, arteriosclerosis, epilepsy, etc.).

Let us briefly consider the merits of the neurological and relaxed ligaments theories. The former hypothesis is a purely speculative one, and there are no grounds whatever for directly implicating the nervous system except in so far as every local change is at bottom a trophic one. As to the relaxation of the ligaments, if this does exist, it is unquestionably the effect and not the cause of the bowing of the radius with disturbances in the wrist.

The argument that the preponderant action of the flexors is in direct etiological relation to the deformity is positively refuted by the distinct existence of a backward type.

Now, with youth, the female sex, and hereditary predisposition as contributory factors, what is the actual cause of this spontaneous and progressive deformity which involves primarily the radius?

The most frequently recurring and most ardently defended suggestion is that the deformity is one of a late rickets. The question as to

whether rachitis tarda is a clinical entity or not, is still a moot question. The pædiatrists and internists who have the best opportunities for investigation are almost unanimously united against recognizing it, (Monti, Vierordt, Marfan). Many of the most eminent admit never having seen a case that might be looked upon as an example (Holt), for the genu valgum, coxa vara, pes planus, and scoliosis of youth do still not deserve to be so classified, notwithstanding Mikulicz's opinion to the contrary. It is not my place here to enter upon this part of the discussion, but these facts in themselves constitute a *prima facie* case against the late rickets theory to explain a Madelung deformity.

Were we even to admit the existence of a rachitis tarda, it is extremely improbable that this disease of metabolism should localize itself in just one or both radii alone. Further, the believers in the existence of a late rickets (Clutton, Roos) all insist that general epiphyseal lesions and constitutional symptoms are essential for a diagnosis. To be sure, since Duplay first suggested the theory, the various subsequent writers have striven to find other traces of rickets, but the attempt has been a forced one, and distinctly unsuccessful. With the exception of Franke's patient, who had passed through a severe early rickets, and who had a variety of decided rachitic deformities, of which the wrist lesion may or may not have been one, not another case shows marked signs of rickets. Eighteen cases are supposed to show evidences of this disease, among which a slight scoliosis was noted twelve times, cubitus valgus four times, genu valgum twice, slight funnel chest twice, and pes valgus five times; no dwarfism, no pelvic deformities, no marked rosary, no Harrison's groove, no distinct tibial curvatures, no parietal or frontal prominences, and no thickened epiphyses, as one would naturally expect to find associated with such advanced changes in bones not even subjected to static influences.

These insignificant skeletal changes found in the tabulated cases are, if anything, less than one would find in the same number of young girls from the poorer classes selected indiscriminately. I am convinced that if fifty-nine such individuals were examined, one would certainly discover more than twenty per cent of "slight scoliosis."

Of course one must admit that in a severe infantile rickets with multiform osseous lesions, a bowing of the radius may develop which may simulate a Madelung deformity, but I see no reason for holding a rachitis, whether early or late, responsible for an isolated deformation such as exists in the condition which we are studying.

The above arguments apply equally well against an early osteomalacia which, according to Looser and the more recent investigators, is identical with late rickets.

There are no grounds for believing that the malady is an example of any of the following conditions: osteitis fibrosa, osteoporosis, osteogenesis imperfecta, osteopsathyrosis.

Closer to the correct solution comes the suggestion that the deformity is a disease of the epiphyseal cartilage related to the formation of multiple cartilaginous exostoses, though this idea requires some modification. The cartilage itself is not really the ossifying organ. It is simply a softer, replaceable tissue which permits of longitudinal bony growth from the adjacent ends of diaphysis and epiphysis where the osteoplastic changes take place. In view of this fact, it is evident that the radial curvature is due not to a disease of the cartilage, but to an irregular ossification involving principally the lower end of the shaft where the growth is most active. This occurs so that, in the forward bowing, the posterior portion of the lower end of the shaft continues to grow, or grows more rapidly, while there is a cessation or only a diminution, of growth of the anterior portion, and vice versa in the backward type. The ulnar bending is produced by a similar continuance or exaggeration of growth radially, with a corresponding inhibition on the ulnar side. That these bony changes, continuing probably during a period of several years, actually do occur, is clearly seen in the skiagram of my case. I see no grounds for believing that a portion of bone once straight becomes bowed. The site of the bending depends upon the age at which the disease begins, the nearer the lower end of the shaft, the more recent the affection. If the entire bone is curved it may even have begun during intra-

uterine life, though a visible deformity may not exist until years later when the malady has reached its climax. The degree of the curvature is dependent upon the activity of the pathological process.

It must be admitted that occasionally like changes take place in the ossification of the proximal portion of the epiphysis which may become wedge-shaped and contribute to the deformation; but these epiphyseal changes are rare, and only very exceptionally are they alone sufficient to produce the deformity.

An involvement of the cartilage may also exist and exaggerate the deformity by hypertrophying on the convex side, but it is highly improbable that this alone can produce an apparent subluxation of the wrist.

The lower end of the forearm is, as Kienböck has pointed out, one of the sites of most active growth, and these changes here are distinctly analogous to those of genu valgum and genu varum. That these last two should be so much more frequent is due to the static conditions, for the continuous weight of the body must have some effect in producing the deformity and in intensifying mild cases. I am also of the opinion that the cubitus valgus et varus, the coxa vara et valga, the scoliosis and the pes planus of adolescence are all allied to Madelung's deformity. I further believe that the anterior type of the wrist deformity is much the more common because:

1. The anterior curvature is the more natural tendency, as normally there is a slight bowing in this direction. As a matter of fact, slight exaggerations of this normal tendency are not uncommon. In a similar manner the greater frequency of genu valgum over genu varum may be explained.

2. The flexor muscles usually exert a more powerful pull which helps to bend the radius in a forward direction.

All the other bony changes are secondary. The frequent exostoses are simply an expression of this irregular ossification. The thickening of the free dorsal and the atrophy of the palmar edge of the lower extremity of the radius in anterior cases is due, as Madelung correctly observed, to a release of pressure on the one hand and an increase on the other.

The bowing backward or forward of the ulna is simply a natural sequence, a growth in the direction of least resistance. This also explains the hyperostosis of the lower end.

SYMPTOMS, COURSE, AND DIAGNOSIS

Madelung's deformity is one which develops spontaneously and progresses gradually. As a general rule, the first symptom is pain in the wrist joint, more or less severe, worse on motion, and usually ceasing after the deformity becomes more pronounced. It is difficult to estimate just how long it takes for the deformity to reach its height, but the average seems to be about two to three years; the minimum, according to our table, being four to six months, and the maximum six years. These figures are not absolutely reliable for it is impossible to tell just when the disease begins and the length of time which elapses before it becomes visible externally. When the deformity has become stationary the main symptoms are fatigue, weakness, and limitation of motion. This last is typical. Those motions which oppose the direction of the deformity are restricted, extension in the forward, and flexion in the backward type, and abduction in both. This limitation is easily understood when one remembers how the joint surfaces have been turned, and if the deformity is sufficient may be so extensive that the motion is totally impossible. On the other hand, the opposite motions, or those in the direction of the deformity, flexion in the forward, and extension in the backward form, and adduction in both, are always increased, and in a compensatory manner, so that the totals of flexion and extension, and abduction and adduction, are about normal.

Supination and pronation are usually somewhat diminished, while the motions of the intercarpal joints are occasionally increased.

The deformity is irreducible, but, in some instances, the end of the ulna can be depressed into place, although when pressure is released there is a recurrence of the dislocation.

Externally the deformity is quite characteristic, as the illustrations show (Figs. 1, 2, 3, 4, 9).

As to the diagnosis, the history and radiographic examination will clear up the most puzzling case, but it must be remembered that numerous conditions can produce deformities

which simulate Madelung's so closely that they might easily be mistaken for it:

1. Simple traumatic dislocations of the wrist.
2. Congenital anomalies(Cruveilhier, Smith).
3. Professional deformities (Bégin, Dupuytren).
4. Deformity after hysterical contracture (Barthès).
5. Pathological dislocations following inflammatory conditions [traumatic hydrathrosis (Lesauvage), tenosynovitis crepitans (Madelung), caries or epiphysitis of the lower end of the radius (Busch, Riedinger), caries sicca (Depage), arthritis deformans (Siegrist)].
6. Rickets with bowing of both bones of the forearm, particularly the radius (Riedinger).
7. Arrest of development after fracture at the epiphyseal junction (Czerny).
8. Deformity after fracture of the lower end of the radius with dislocation of the head of the ulna (forward type, Wittek, Sauer, Ewald; backward type, Mouchet and Genil-Perrin).
9. Fracture of the carpus (Barthès).
10. Exostosis of the ulna with shortening of this bone (Bessel-Hagen, Kienböck).
11. Spinal arthropathies of tabes and syringomyelia.

PROGNOSIS AND TREATMENT

With appropriate treatment the prognosis as to the reduction of the deformity and the restoration of function is excellent.

Obviously palliative measures such as sparing the extremity can do nothing more than relieve the pain. An orthopædic apparatus is entireless useless even when applied in the stage of development. Tenotomy is absolutely unjustified, and resection of the ulna is thoroughly unsound.

The rational radical treatment, should the functional disturbances and the cosmetic requirements warrant it, is an osteotomy of the deformed radius after the deformity has reached its height. This means that if necessary one should wait for operation until after the cessation of growth. Duplay's linear osteotomy, or Poulsen's oblique method, which has been performed seven times, five times successfully, may serve in mild cases, but I believe that in extreme deformities a cuneiform operation with the base of the wedge at the site of convexity and bone suture will be much more satisfactory. I propose to carry out this plan in my case, and at the same time procure sufficient bony tissue for histological examination. At some future date, I hope to be able to report both upon the result of the operative interference and the microscopical findings.

NOMENCLATURE

Finally I wish to suggest a distinct revision in the naming of this condition. I would positively discard the use of the terms "congenital," "subluxation," and "dislocation," as they are completely misleading. One might still speak of a forward or backward form of a Madelung's deformity, provided one accepted the correct conception of the pathological picture, but it would avoid confusion if an anatomical and symptomatic title were used, — forward or backward idiopathic progressive curvature of the radius. We could further adopt an orthopædic nomenclature and speak of the forward cases as carpus varus, and the backward as carpus valgus. This would be quite in accordance with the naming of analogous elbow, hip, or knee lesions (cubitus valgus, coxa vara, genu valgum, etc.), for though the joints are strictly speaking not involved, the irregular growth of the adjacent bone causes a joint deformity, and the authority of common usage has given these names justification. As to the use of varus and valgus, these terms as employed never signify pure adduction or abduction, and as the natural position of the forearm is one of midpronation, rather than the so-called anatomical position, varus would simply mean a displacement of the wrist toward, and valgus displacement away from the body.

CONCLUSIONS

1. The so-called Madelung's deformity of the wrist is due to an anteroposterior bowing of the radius, usually of the shaft proper, occasionally of the epiphysis, and sometimes of both. This produces a deviation of the articular surface and an apparent subluxation of the wrist. The deformity is usually bilateral.

2. Heredity, the female sex, and youth (about eleven years) are predisposing factors,

and the exciting cause is a local dystrophy, an irregular ossification of the distal extremity of the diaphysis, or of the proximal portion of the epiphysis, or both.

3. There are two distinct types, a forward or common and a backward or rarer one, in both of which, however, there is generally an exaggeration of the normal curvature of the radius toward the ulna. A corresponding increased inclination of the joint surface toward the ulna results, with adduction of the hand and an angulation of the first row of carpal bones. The carpus usually retains its normal relations to the radius, but the caput ulnæ is dislocated backward or forward in the lower radioulnar and triangular-cuneiform articulations.

4. The disease is one of the growth period developing spontaneously, with pain, and progressing gradually (two to three years) with limitation of motion against, and increase of motion in the direction of the deformity. Numerous conditions simulate the lesion, but the history and the X-ray will establish the diagnosis.

5. The prognosis is good and treatment consists in osteotomy of the radius after the disease has run its course and the symptoms or deformity justify surgical intervention. Linear osteotomy should be performed in mild, and cuneiform in severe cases.

6. Forward and backward idiopathic progressive curvature of the radius are rational terms for the condition, or the orthopædic names of carpus varus or carpus valgus might be used.

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I. FORWARD TYPE

CASE 1. Malgaigne, 1855, male, age 10–12, unilateral. Mason. History of fracture at middle of radius, 3 years before. Lifted heavy weights. Radius bowed at lower extremity; articular surface turned forward; exostosis anteriorly just above wrist. Carpus and hand displaced forward and upward. Symptoms, pain in beginning. Function good, except extension and pronation. Course, 18 months. Remarks, irreducible.

CASE 2. Weber, 1859, female, age 16, right arm. History, no trauma. Radius projects over wrist. Ulna projects over wrist. Carpus and hand displaced forward. Symptoms, pain in beginning and on motion. Function, extension limited. Course, gradual. Treatment, reduction under narcosis, but recurrence; later, plaster and apparatus. Remarks, reduction maintained.

CASE 3. Busch, 1864, female, bilateral. History, no trauma. Radius, half of joint surface can be felt posteriorly. Ulna, end prominent. Carpus and hand displaced forward. Symptoms, pain on working. Function, limitation of movement. Treatment, attempted reduction under narcosis, later tenotomy of flexor carpi ulnaris and palmaris longus tendons. Remarks, poor result; progression.

CASE 4. Jean, 1875, female, childhood, bilateral, especially right. Radius, lower extremity bent forward. Ulna dislocated backward; hyperostosis. Carpus and hand displaced forward; in normal relation to radius but subluxated in carpoulnar articulation. Function, extension limited. Remarks, dissection at 73 years of age. Congenital?

CASE 5. Madelung, 1878, female, childhood, left arm. Radius bowed forward at epiphysis; articular surface turned toward vola; dorsal edge free and prominent. Ulna dislocated backward. Carpus and hand subluxated forward, articulating with anterior half of joint surface of radius. Function, motion increased in intercarpal joint. Remarks, dissection at 20 years of age.

CASE 6. Madelung, 1878 (seen in 1868), female, age 18, bilateral. Peasant. Carpus and hand, marked forward dislocation. Function, interference with work. Course 1 to 2 years. Treatment, palliative, avoidance of heavy work, especially extension, exercise, leather bracelet. Remarks, pain relieved.

CASE 7. Madelung, 1878 (seen in 1871), female, age 16, right arm. History, of well-to-do family. Course, 1 to 2 years. Treatment, palliative, avoidance of heavy work, especially extension, exercise, leather bracelet. Remarks, pain relieved.

CASE 8. Madelung, 1878, male, age 14, bilateral. Tanner. History, lifted heavy weights. Ulna, end prominent. Symptoms, pain during development. Function, extension limited. Course 1 to 2 years. Treatment, palliative, avoidance of heavy work, especially extension, exercise, leather bracelet. Remarks, pain relieved.

CASE 9. Madelung, 1878, (seen in 1875), female, childhood, left arm. Carpus and hand, marked subluxation forward. Symptoms, pain. Function, extension limited. Course 1 to 2 years. Treatment, palliative, avoidance of heavy work, especially extension, exercise, leather bracelet. Remarks, pain relieved.

CASE 10. Pooley, 1880, female, age 8 (congenital?), bilateral. History, no trauma or disease. Radius shortened 1½ inches. Ulna, end prominent; hyperostosis; shortened 1½ inches. Carpus dislocated forward. Symptoms, pain on milking cows at first; tires on hard work. Function, extension limited, flexion increased, (at 33 years of age). No other bony lesions.

CASE 11. Félix, 1884, female, age 14, bilateral, especially left. Laundress. Ulna dislocated backward. Carpus and hand subluxated forward. Symptoms, severe pain in beginning. Function, disturbed; supination impossible. Treatment, orthopædic appliance; electricity. Remarks, recurrence.

CASE 12. Duplay, 1885, female, age 9, left arm. History, strain 1-2 years before. Radius, lower end bent forward. Ulna, lower end dislocated backward; hyperostosis. Carpus and hand, apparent forward subluxation. Function, no loss. Course, within 4 years. Accompanying bony lesions, scoliosis. Treat-

ment, orthopædic appliance; later, osteotomy of radius 3 cm. above joint. Remarks, good result.

CASE 13. von Bergmann, 1888, female, childhood, bilateral. History, chlorosis; weak muscles; no trauma. Carpus and hand, forward subluxation. Symptoms, severe pain in beginning. Function, extension limited. Course, gradual. Accompanying bony lesion, bilateral shortening of fourth metacarpus.

CASE 14. Duplay, 1891, female, age 14, bilateral, especially right. Radius, lower end bent forward. Ulna, slight bowing forward; head dislocated backward; hyperostosis. Carpus and hand displaced forward. Symptoms, vague pain in beginning and slight at 7 years; easily fatigued. Function, slight disturbance. Course, 4–6 months, each side.

CASE 15. Bode, 1891, female, age 13, left arm. Ulna displaced forward. Accompanying bony lesion, hemiatrophy of right side. Remarks, reducible on pressure.

CASE 16. Guépin, 1892, female, childhood, bilateral, especially left. History, slight trauma, left, as child. Ulna dislocated backward on radius and carpus. Carpus and hand dislocated forward on ulna and subluxated on carpus. Marked heredity; mother, father, sisters, brothers, uncles, aunts, nieces, and nephews have similar deformity. Remarks, can be reduced on right side by pressure. "Touche de piano."

CASE 17. Guépin, 1892, female, bilateral, especially left. Ulna dislocated backward on radius and carpus. Carpus and hand dislocated forward on ulna and subluxated on radius. Heredity, mother of above.

CASE 18. Redard, 1892, female, age 14, bilateral. Washwoman. History, fell on left hand. No rickets. Radius, marked bowing forward. Ulna bowed forward. Carpus and hand subluxation position. Symptoms, active pain, especially on wringing wash. Function, motion limited, especially extension and supination. Treatment, rest, galvanism, phosphorus.

CASE 19. Malfuson, 1894, female, age 13, bilateral, especially right. Seamstress. History, sudden supination. Radius, slight bowing of lower quarter. Carpus and hand, subluxation; hand toward ulna. Symptoms, intermittent pain. Function, on right side, extension limited and supination painful. Accompanying bony lesion, mild scoliosis. Heredity, mother has same deformity. Treatment, massage, sulphur baths, iodine.

CASE 20. Malfuson, 1894, female, bilateral. Radius bowing forward. Carpus and hand, subluxation of wrist. Symptoms, no pain. Function, no disturbance. Heredity, mother of above.

CASE 21. Jagot, 1897, female, age 13-14, bilateral. Milkmaid. Radius bowing forward. Ulna dislocated backward and hypertrophied in lower third. Carpus and hand displaced forward. Symptoms, no pain. Function, extension and lateral motions limited. Heredity, father, uncle, and grandfather have thick wrists. Remarks, X-ray.

CASE 22. Ch. Nélaton, 1897, unilateral. Radius bowed forward. Carpus and hand displaced forward. Remarks, dissection.

CASE 23. Guéry, 1898, male, age 13, left arm. Carpet maker. Strain history. Radius, deviation forward of articular surface; not shortened or hypertrophied. Ulna dislocated backward, and hyperostosis. Carpus and hand displaced forward and toward ulna; in normal relation to radius. Symptoms, marked pain. Function, flexion and abduction increased; extension and adduction diminished. Course, gradual. Treatment, plaster, then bracelet. Remarks, can be reduced, but recurs; improvement; X-ray.

CASE 24. Delbet, 1899, female, age 12, bilateral. Radius bowed forward at lower end. Ulna dislocated backward. Carpus and hand displaced forward and toward ulna. Symptoms, pain. Function, disturbance in writing. Course, 4 years. Treatment, osteotomy of radius; plaster. Remarks, tendency to recur.

CASE 25. Cabeça, 1899, female, age 14, bilateral. History, no trauma. Plays piano. Radius bowed forward at lower end. Ulna dislocated backward; no curves. Carpus and hand displaced forward and outward. Symptoms, pain in beginning. Function, normal motion. Remarks, X-ray.

CASE 26. Gangolphe, 1899, female, age 14, bilateral, especially right. Does embroidery. History, no rickets or trauma. Radius bowed forward and toward ulna at lower end. Ulna dislocated backward. Symptoms, severe pain. Function, extension limited, right. Course, 1 year. Accompanying bony lesions, slight scoliosis; laxity of ligaments of left knee. Heredity, mother had same deformity. Remarks, ulna can be depressed; X-ray.

CASE 27. Gangolphe, 1899, female, age 11, bilateral, especially right. Seamstress. History, no rickets or trauma. Radius bowed forward and toward ulna at lower end; right 3 cm. shorter than left. Ulna dislocated backward; right 2 cm. shorter than left. Carpus and hand displaced forward; adduction. Symptoms, occasional pain, easily fatigued. Function, extension limited, especially right, also pronation and supination (total ½ normal). Course, 4 years. Heredity, mother of above. Remarks, X-ray.

CASE 28. Bérard, 1899, female, bilateral, especially left. Radius bowed forward and toward ulna at epiphyseal line; exostoses, especially left. Ulna dislocated backward. Carpus and hand displaced forward; partial ankylosis between scaphoid, and semilunar and articular surface of radius; subluxation of second row on first row backward. Remarks, dissection at 65 years of age.

CASE 29. Roget, 1899, female, age 8–10, bilateral, especially right. History, no rickets or trauma. Radius bowed forward and toward ulna at lower end. Ulna, dislocated backward. Carpus and hand displaced forward; adduction. Symptoms, fatigue in writing. Course, 6 years. Accompanying bony lesion, cubitus valgus. Heredity, mother and grandfather have prominent ulnæ.

CASE 30. Dekeyser, female, age 14, right arm. Radius, lower end bowed forward. Ulna dislocated backward; shortened. Carpus and hand displaced forward from ulna; in normal relation to radius. Symp-

toms, little pain; fatigue. Function, power weak. Heredity, mother has similar lesion. Treatment, rest. Remarks, X-ray.

CASE 31. Dekeyser, 1901, female, childhood, left arm. Radius, lower end bowed forward. Ulna dislocated back; shortened. Carpus and hand displaced forward from ulna; in normal relation to radius Function, flexion increased. Course, gradual. Heredity, mother of above.

CASE 32. Gevaert, 1902, male, age 14, bilateral. Weaver. History, continuous traction. Radius bowed forward at lower end. Ulna displaced backward. Carpus and hand displaced forward but in normal relation to radius. Symptoms, fatigue. Function, flexion, left, slightly diminished; weakness and clumsiness. Course, 2 years. Accompanying bony lesions, dorsal scoliosis; compensatory lumbar scoliosis; genu valgum right, and slightly left. Treatment, massage; electricity; passive motion. Remarks, result satisfactory; X-ray.

CASE 33. Ardouin, 1902, female, childhood, bilateral, especially left. Waitress. Radius bowed forward; slightly shortened, especially left, 5-6 cm. Ulna, dislocated backward; shortened, especially left, 5-6 cm. Carpus and hand displaced forward; in normal relation to radius. Function, slight weakness. Accompanying bony lesion, slight scoliosis. Heredity, brother has large wrists. Remarks, X-ray.

CASE 34. Abadie, 1903, male, age 13, left arm. Cook. History, fall on hand at 8–9 years, fracture (?), later, hard work. Radius, lower end bowed forward. Shortened 10 cm.; exostosis. Ulna dislocated backward, slightly curved toward radius at lower end; shortened 10 cm. Carpus and hand displaced forward, carpus in normal relation to radius; hand deviated radially. Function, limitation of movement in beginning; weakness; pronation and supination limited. Course, several years. Remarks, X-ray.

CASE 35. Cnopf, 1903, female, age 12, right arm. Radius, short; dorsal concave bowing in upper third; moderate volar concavity lower two-thirds; at lower end sharp bend forward and toward ulna with deviation of joint surface. Ulna, dorsal and radial convex bowing in upper extremity; turned on axis at lower end 90°; dislocated backward. Carpus and hand displaced 1.5 cm. forward; cuneiform dislocated forward and upward; carpus and radius in normal relation. Symptoms, no pain. Function, extension slightly limited. Course, 2½ years. Remarks, X-ray.

CASE 36. Bennecke, 1904, female, age 15, bilateral, especially right. Worked in printing shop, carried heavy weights. Radius, forward bowing; end thickened; dorsal edge over carpus shortened. Ulna displaced backwards; hyperostosis; shortened. Carpus and hand displaced forward; first row wedge-shaped; second row extended on first. Symptoms, pain in beginning and upon work. Function, extension diminished; pronation and supination very limited (total about 90°); flexion and intercarpal motion increased. Accompanying bony lesions, slight indications of scoliosis; cubitus valgus, right. Remarks, X-ray.

CASE 37. Poulsen, 1904, female, age 12, left arm. Radius, lower third bowed forward sharply with turning of joint surface; thickened; shortened 3 cm. Ulna displaced backward; slight forward bowing; thickened; shortened 3 cm. Carpus and hand displaced forward and toward radius; carpus and radius in normal relation. Symptoms, no pain. Function, extension and supination (one half) limited. Course, 4 years. Treatment, oblique linear osteotomy of the radius; bandage in extension. Remarks, tendency to recur; X-ray.

CASE 38. Poulsen, 1904, female, age 12, bilateral, especially left. Servant. Radius, whole bone bowed forward, especially at lower end, also bowed toward ulna; joint surface deviated forward and excavated. Ulna, displaced backward; slight bowing forward; joint surface excavated. Carpus and hand displaced forward, but in normal relation to radius. Symptoms, no pain. Function, slight limitation of supination. Course, 1 year. Treatment, oblique linear osteotomy of the radius; bandage. Remarks, improvement; X-ray.

CASE 39. Leclerc, 1905, female, childhood, bilateral. Corset-maker. History, joined hands pulled violently at 5. Radius curved forward. Ulna dislocated backward on radius and wrist. Carpus and hand, apparent forward dislocation; first row of carpus wedge-shaped, second row extended on first. Symptoms, pains and cramps when overworked. Function, flexion and abduction slightly exaggerated. Remarks, ulna can be reduced on pressure but recurs; X-ray.

CASE 40. Schulze, 1905, female, age 9, right arm. History, hand turned at play. Radius, lower half bowed forward; dorsal edge of epiphysis prominent. Ulna displaced backward and elongated 2 cm. Carpus and hand displaced forward. Symptoms, no pain; easily fatigued, especially by piano-playing. Function, extension one-third normal; adduction slightly, abduction considerably, limited; flexion increased. Accompanying bony lesions, cubitus valgus, right; bilateral, congenital dislocation of the hip. Treatment, massage; electricity to the extensors; bandage. Remarks, X-ray.

CASE 41. Th. Volkmann, 1905, female, before 16, bilateral. Radius, lower third bowed forward and toward ulna; shortened. Ulna dislocated backward on carpus; shortened. Carpus and hand displaced forward, but in normal relation to radius. Symptoms, no pain. Function, flexion and supination limited. Course, gradual. Heredity, sister of eight has distinct indication of same deformity. Treatment, none. Remarks, irreducible; X-ray.

CASE 42. Th. Volkmann, 1905, female, before 14, bilateral, especially right. Radius, bowed. Ulna dislocated backward from radius and wrist. Carpus and hand displaced forward. Symptoms, no pain. Function, no serious disturbance. Accompanying bony lesions, cubitus valgus; slight pes planus. Heredity, mother and grandmother have same deformity. Treatment, none. Remarks, ulna reducible on pressure, but recurs; X-ray.

CASE 43. Natvig, 1905, male, age 14, bilateral, especially right. History, thin, pale child. Carpus

displaced forward. Symptoms, pain in beginning. Function, extension and supination limited.

CASE 44. Solberg, 1906, male, age 16½, bilateral, especially right. Policeman. Ulna end prominent. Carpus displaced forward. Symptoms, pain and fatigue after heavy work in beginning. Function, no loss at 34 years of age. Course, 1½ years. Accompanying bony lesions slightly dwarfed, slight genu varum and flat foot, left. Heredity, brother has same deformity.

CASE 45. Solberg, 1906, male, age 15, right arm. Carpus displaced forward. Symptoms, no pain. Accompanying bony lesions, slightly dwarfed and slight genu varum. Heredity, older brother of above. Parents are cousins. Remarks, seen at 40 years of age.

CASE 46. Piollet, 1906, female, age 12, bilateral. Shopgirl. Radius, lower third bowed forward. Ulna dislocated backward. Carpus and hand displaced forward. Symptoms, pain in beginning. Function, extension limited. Course, less than 4 years. No heredity; slightly infantile. Treatment, orthopædic apparatus. Remarks, no result; X-ray.

CASE 47. Schade, 1906, female, before 8, bilateral, especially right. History, no trauma. Radius, lower third bowed forward and toward ulna. Ulna dislocated backward on carpus and radius. Carpus and hand displaced forward; slightly flexed and adducted; in normal relation with radius. Symptoms, no pain. Function, extension limited; abduction impossible; flexion increased. Accompanying bony lesions; slight rosary; lumbar scoliosis. Remarks, X-ray.

CASE 48. Putti, 1906, female, age 15, left arm. Household work; washing. History, no trauma. Radius, lower third bowed forward and toward ulna. Ulna dislocated backward and bowed slightly forward. Carpus and hand displaced forward; in normal relation with radius. Symptoms, pain. Function, extension limited; all movements painful. Course about 1 year. Accompanying bony lesion; cubitus valgus. Treatment, oblique osteotomy of radius; plaster. Remarks, ulna can be reduced, but recurs; good result; X-ray.

CASE 49. Sauer, 1906, female, childhood, bilateral. Servant. History, no trauma. Radius, lower half bowed forward and toward ulna, especially at epiphysis; joint surface at angle of 35° toward ulna; interosseous crest prominent; shortened 1-2 cm. Ulna displaced backward; hyperostosis; interosseous crest prominent. Carpus and hand, first row displaced forward with radius; second row has remained dorsal; slight adduction. Symptoms, no pain. Function, extension limited (135°); abduction almost gone; flexion (80°) and adduction increased. Accompanying bony lesion, funnel chest. Heredity, several sisters and brothers are said to have similarly deformed wrists. Treatment, avoidance of forced flexion; exercise. Remarks, irreducible; X-ray.

CASE 50. Sauer, 1906, female, age 18, left arm. Servant. Radius, normal shape; broad irregular epiphyseal line. Ulna, normal shape; dislocated backward. Carpus and hand displaced forward; in normal relation to radius. Symptoms, easily tired, especially in wringing wash. Function, extension diminished; flexion increased. Course, 1 year. Accompanying bony lesions, slight flat foot and bilateral genu valgum; epiphyseal line of right tibia broad and irregular. Remarks, X-ray.

CASE 51. Sauer, 1906, female, before 20, left arm. Servant. Radius bowed forward at lower end; shortened. Ulna dislocated backward; slight bowing backward. Carpus and hand displaced forward; in normal relation with radius. . Symptoms, pain when doing hard work. Function, no disturbance of motion. Remarks, X-ray.

CASE 52. Stieda, 1907, female. Radius bowed forward. Carpus and hand subluxated forward. Remarks, X-ray.

CASE 53. Lénormant, 1907, female, early childhood, before 13, right arm. History, rheumatism at 8; no trauma or rickets. Radius, lower fourth bowed forward and joint surface turned; epiphyseal cartilage oblique and irregular; neck shorter; head lower; shortened 1 cm; exostosis. Ulna, dislocated backward; hyperostosis. Carpus and hand displaced forward; no radiocarpal dislocation. Symptoms, pain, right. Function, extension limited; flexion increased; weakness. Course, gradual. Accompanying bony lesions, slight depression at xiphoid; dorsal scoliosis. Treatment, osteotomy of radius. Remarks good result; X-ray.

CASE 54. Pels-Leusden, 1907, female, age 14, bilateral, especially right. Servant. Hard work. Radius bowed forward and toward ulna with turning of joint surface; irregular exostosis, right; right radius shorter but bowed same as left. Ulna displaced backward. Carpus and hand displaced forward; no radiocarpal dislocation. Symptoms, pain, right. Function, slight diminution in extension and abduction. Remarks, X-ray.

CASE 55. Pels-Leusden, 1907, female, age 12, bilateral. Radius bowed forward and toward ulna with turning of joint surfaces. At 20 years epiphyseal cartilage noticeable; exostoses proximal to cartilage and lateral. Ulna displaced backward. Carpus and hand displaced forward; no radiocarpal dislocation. Function, motion lessened. Remarks, X-ray.

CASE 56. Estor, 1907, female, birth, bilateral, especially right. History, no trauma. Radius bowed slightly inward and markedly forward with turning of joint surface. Ulna dislocated backward on radius and carpus; lower fourth bowed outward and backward. Carpus and hand displaced forward; os magnum prominent. Function, no disturbance of motion. No other skeletal anomalies. Heredity, father has same deformity, more marked. Remarks, ulna can be reduced, but recurs; X-ray.

CASE 57. Peckham, 1907, female, age 14 (congenital?), bilateral. Radius, lower end bowed forward. Ulna dislocated backward. Carpus and hand displaced forward. Treatment, ulna end freed and reduced. Remarks, improved; X-ray.

CASE 58. Siegrist, 1908, female, age 11, bilateral, especially left. History, well-to-do family; no trauma or heavy work; no rickets. Plays piano. Radius,

bowing of entire bone, especially at lower end, forward and toward ulna with turning of joint surface; exostosis, left. Ulna displaced backward. Carpus and hand displaced forward and toward ulna; first row wedge-shaped. Symptoms, lively pain in beginning. Function, left flexion, extension, adduction, abduction, and supination diminished. Course, several years. Accompanying bony lesions, slight dorsal scoliosis and pes valgus. Heredity, maternal grandmother, mother, and two sisters have similarly deformed wrists, but in a lesser degree. Treatment, orthopædic apparatus. Remarks, no result; X-ray.

CASE 59. Siegrist, 1908, female, age 14, bilateral, especially left. Saleswoman. History, no trauma, heavy work, nor rickets. Radius, regular forward bowing of entire bone and turning of joint surface. Ulna displaced backward; lower end bowed backward. Carpus and hand, moderate displacement forward. Symptoms, severe pain until deformity was pronounced. Function, extension limited and flexion increased, left. Course, 2–3 years. Accompanying bony lesions, scoliosis and left pes valgoplanus. Heredity, maternal grandmother said to have same deformity. Remarks X-ray.

CASE 60. Siegrist, 1908, female, age 10–12, bilateral, especially right. Washwoman. History, no trauma; heavy work. Radius, regular forward bowing of entire bone and of lower end also toward ulna; deviation of joint surface on two axes; shortened. Ulna displaced backward. Carpus and hand, moderate displacement forward. Symptoms, severe pain in beginning and still on certain movements. Function, all motions only slightly limited. Course, several years. Heredity, 25-year-old daughter has mild degree of, and two younger daughters have indications of, same deformity. Remarks, X-ray.

CASE 61. Franke, 1908, female, early childhood, bilateral. History, rickets as child. Radius, slight bowing at middle toward ulna and near articular surface, markedly forward on volar side; turning of joint surface toward ulna (40°) and forward (70°–80°); epiphyseal line present at 37 years; irregular and at angle of 40° to shaft; epiphysis wedge-shape, thicker dorsally and hypertrophied on dorsal edge; exostoses; shortened 4 cm. Ulna displaced backward; bowed toward radius; epiphyseal line distinct at 37 years; shortened 2 cm.; hyperostosis. Carpus and hand displaced forward and toward ulna; hands rotated outward; subluxated on ulna; angulation of first row of carpus; extension of second row. Symptoms, no pain. Function, extension and abduction limited. Accompanying bony lesions, dwarfism, exostoses of tibiæ and fibulæ; mild rosary; epiphyses of forearms and tibiæ thickened; epiphyseal lines of numerous bones present at 37 years; slight pes planus; genu valgum and cubitus valgus; bones and muscles poorly developed; osteoporosis (?), bowing of second metacarpi. Remarks, X-ray and dissection at 37 years of age.

CASE 62. Brinsmade, 1908, female, age 12, bilateral, especially right. History, hands were twisted. Radius, lower end bowed forward and lower half, toward ulna. Ulna displaced backward. Carpus and hand displaced forward. Course, 1½ years. Accompanying bony lesions, slight scoliosis and slight bowing of right tibia. Remarks, X-ray.

II. BACKWARD TYPE.

CASE 1. Kirmisson, 1902, female, age 10½, bilateral, especially right. History, no rickets or trauma. Radius, inferior extremity bowed backward and toward ulna (lower third), with deviation of articular surface; shortened 3 cm. Ulna, inferior extremity displaced forward; shortened 3 cm. Carpus and hand displaced backward and toward ulna; in normal relation to radius. Symptoms, fatigue; pain on flexion. Function, flexion painful and diminished; abduction impossible; supination limited; extension and adduction increased. Course, less than 1½ years. Accompanying bony lesions, right dorsal scoliosis with curvature of right ribs; curvature of spinal border of scapulæ. Treatment, osteotomy of radius with resection of overriding bone; plaster. Remarks, good result; X-ray.

CASE 2. Stetten, 1908, female, age 11½, bilateral, especially left. Schoolgirl. History, no rickets; fall after beginning of deformity. Radius, lower half bowed back and toward ulna (especially lower third) with deviation of joint surface; shortened about 4 cm; exostosis, left. Ulna dislocated forward; slight exaggeration of normal forward curvature; shortened about 2 cm. Carpus and hand displaced backward and toward ulna; angulation of first row of carpus; in normal relation with radius. Symptoms, slight pain, right. Function, flexion diminished; abduction almost nil, left, and diminished, right; adduction and extension increased; pronation and supination limited. Course, 6 months. Heredity, mother has prominent ulnæ. Remarks, X-ray.

PARATHYROID TUMORS

With Report of a Case

By J. CHALMERS DA COSTA, M. D., Philadelphia, Pennsylvania

VERY few cases of parathyroid tumor have been reported. Probably the condition has been met with in some cases in which it has not been identified; but, in spite of this, it seems certain that parathyroid tumors are surgical rarities. Richardson, in his treatise upon the thyroid and parathyroid glands, does not mention them at all; and the younger Kocher, in his article on the thyroid gland in the fourth volume of Keen's Surgery, barely refers to them, but tells us nothing whatever about them.

Of late, the parathyroid glands have attracted much attention. A number of studies upon them have been published; and surgeons, experimenters, and pathologists are actively engaged in investigations along their various lines. We have learned positively that tetany follows the removal of, serious damage to, or interference with the blood supply of the parathyroids. Owing to the danger in removing or interfering with these important structures, the technique of goiter operations has been greatly modified; and the intracapsular operation, as performed to-day by the Mayos, Professor Halsted, and others, is founded upon a careful anatomical study of the parathyroid glands, their blood supply, and their surgical relations. Among those to whom we are indebted for valuable contributions are MacCallum, Halsted, Charles Mayo, Schirmer, Segale, Erdheim, Thompson, Forsythe, Pool, Monnier, Caro, Getzowa, Evans, Geis, Branham, Vincent, and Jolly. The questions of the nature of parathyroid tumors, of the possibility of recognizing them, and of the advisability of removing them are new and important; hence the report of my case.

The patient, M. K., a white married female thirty-two years of age, was referred to me by Dr. Hensyl, of Berwick, Pa., and was admitted to the Jefferson Hospital October 29, 1906. Her father had been a victim of heart disease, and one brother had suffered with cardiac trouble. One brother had died of diabetes, and one sister had died at the age of thirty-two, of some abdominal difficulty. One brother is living and well. There is no history of tuberculosis in the family. It is said that twenty years ago her father had a small cancer removed from just below the left eye.

When a child, the patient had measles and mumps. Otherwise, she enjoyed excellent health until she reached the age of fourteen years, when menstrual pains first began. Ever since that time, she has been a sufferer from dysmenorrhea, being obliged to go to bed at every monthly period. Although these painful attacks occurred each month, no menstrual discharge was apparent until she was eighteen years of age. The suppression of flow caused her a great deal of worry, and she became extremely nervous and greatly depressed. Even after the menstrual flow had been established, it was always very irregular, usually lasting from three to five days.

The patient was married at the age of twenty-eight; that is, six years ago. Two years after her marriage — that is, when she was thirty — she was operated upon for appendicitis. At the time of the operation, she was three months pregnant; and four weeks after the operation, she miscarried. She has long suffered with some dyspnea on exertion; but her appetite has been reasonably good, her digestion satisfactory, and her bowels regular.

Nine years ago — that is, when she was twenty-five years of age — she had an attack of acute tonsilitis; and an abscess formed in each tonsil. These abscesses ruptured spontaneously. A few months after the attack of tonsilitis, she noticed that her collar was beginning to feel too tight for her; and on examination, she discovered a distinct fullness on the right side of the neck. This mass slowly, but surely, increased in size. After the performance of the abdominal operation, two years before her admission, the growth began to increase much more rapidly; and shortness of breath on exertion became a much more definite symptom. We thus see that the duration of this growth, when the patient was admitted to the Jefferson Hospital, was about six years and a half; that its period of more rapid growth was about two years; and that the initial growth began soon after the infectious process — that is, suppurative tonsilitis.

The growth was always entirely free from pain. When the patient was recumbent and attempted to raise her head only, the body remaining recumbent, she was sure to have a severe choking attack. During the last three years she has had a slight irritative cough.

On admission, it was found that the patient was thin, neurotic, and pallid. The heart and lungs were apparently normal. The pulse was strong and regular and beat at the rate of 72 a minute. The urine had a specific gravity of 1,018, and contained 1.9 per cent of

urea, but no abnormal elements. The blood examination showed about 5,000,000 red cells, 7,800 leukocytes, and 85 per cent of hemoglobin.

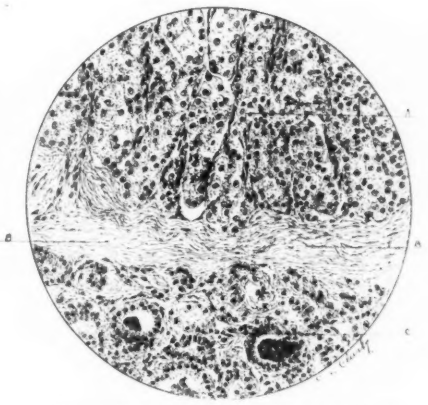
On the right side of the neck, there was a tumor about as large as an orange; and it was overlapped by the sternocleido-mastoid muscle. It passed to some extent back of the clavicle below, and reached within one centimeter of the level of the upper border of the thyroid cartilage above. It also passed to one centimeter to the left of the median line. The tumor was much more prominent when the patient was erect than when she was recumbent. It was smooth; regular in outline, except for a bulb-like projection at its lower anterior portion; and of firm consistency throughout. It moved with the trachea on swallowing, but otherwise was immovable.

A diagnosis of adenomatous goiter was made and two days after admission the growth was removed under local anesthesia, the then almost universal extracapsular operation being performed. Great difficulty was encountered in reaching the lower pole of the supposed thyroid and freeing it, and it was thought that there was an anatomical anomaly of the inferior thyroid artery, which came forward in front of the tumor, instead of being found, as it usually is in a goiter, at the lower and inner side. It was discovered, too, that the growth was in extremely close relation with the recurrent laryngeal nerve of the right side, which was distinctly seen; and great difficulty was experienced in effecting a separation between the nerve and the tumor mass.

No parathyroids were identified. The tumor was brownish yellow and irregular, and presented, in front of the lower portion, a bulb-like projection the size of a walnut, which was somewhat softer and decidedly darker than the remainder of the mass, but apparently a portion of it. After the lower pole had been freed the operation progressed with the ordinary amount of ease. A small piece of gauze was inserted for drainage, and the wound was closed. The patient exhibited no unfavorable after symptoms. The temperature never ascended above 100°. There were no nervous symptoms or dyspnea, and the pulse never became very rapid. For several days, the voice was decidedly affected — the result, probably, of handling the recurrent laryngeal nerve; but it soon became perfectly normal. The drainage strand was removed in twenty-four hours, and primary union was obtained in the wound. The patient went home, apparently cured, nine days after the operation.

Even on inspecting the growth after its removal, I had no doubt of its being thyroid; and my error was first shown me by the report of the pathologist, who reported that the main mass was parathyroid, and that the bulb-like projection about the size of a walnut was the only part of the mass that was thyroid. Dr. Clark Evans made the pathological examination, and Professor Coplin confirmed it.

Portions of the growth were fixed in Heidenhain's solution, dehydrated; infiltrated with paraffin; sectioned; and stained with hematoxylin and eosin, with van Gieson, with Mallory's reticulum stain, and with



Hyperplasia Adenoma of Parathyroid.

A. Parathyroid tissue. The granular, faintly staining cytoplasm is characteristic of the cells in the greater part of the specimen.

B, B. Band of fibrous tissue separating parathyroid from thyroid.

C. Thyroid structure showing near the fibrous band conspicuous increase in connective tissue and atrophy of gland parenchyma. Two of the more perfect acini are partly filled by colloid.

polychrome methylene blue. (See drawing.) It was found that the growth consisted of parathyroid gland and was surrounded by a fibrous capsule. The epithelial-like cells were arranged in fairly distinct columns, or masses, separated by thin walls of vessels, or vascular intercellular tissue. In some areas, the tissue was arranged in the form of acini, lined with cuboidal or polygonal cells; although even in these instances, there was no sharp demarcation between neighboring cells. The protoplasm of most of the cells was granular or vacuolar, and showed weak affinity for acid stains. The nuclei of these cells were spherical, and the majority of them were rich in chromatin. In a number of the indistinct acini were small masses of material that gave the staining reaction of colloid. These were most numerous in small fibroid areas, which will be referred to later. Bands of fibrous tissue, enclosing numerous areas of weakly acidophile substance or distinct masses of cells, were distributed through portions of the section. The fibrillæ were short, irregular in the course, and reacting poorly to stain. Many areas of hæmorrhage appeared at various points in the section. Most of these were recent; but at a few points there were degenerative changes in the bordering gland tissue. Separated from the parathyroid structure by a broad, distinct band of fibrous tissue, containing many large blood vessels, was a portion of attached thyroid. This showed a marked increase of the interstitial tissue, with a corresponding decrease of the parenchymatous. A part of the acini were approximately normal in size, and contained the usual amount of colloid material; but a large number were small. The lining epithelial

cells in contact, or nearly so, contained no colloid. The thyroid structure showed several areas of dense aggregation of mononuclear leukocytes. The thyroid structure proper was very much smaller than a normal gland should be. The tumor was composed of parathyroid structure. The pathologist decided that the condition was one of hyperplasia, or possibly adenoma, of the parathyroid, with chronic interstitial inflammation of the thyroid. Fig. shows a section of this growth, the parathyroid tissue being distinctly separated from the thyroid structure by a band of fibrous connective tissue.

Several cases of parathyroid tumor have been reported, and I am indebted to Dr. Francis D. Patterson for valuable aid in collecting the literature of this subject.

Benjamin (Ziegler's Beitrage, bd. xxxi, 1902, p. 143) notes the case of a man fifty-seven years of age, in whom a tumor rapidly developed in the thyroid region. When the tumor was extirpated, it was the size of an infant's head. It was surrounded by a capsule, in which, at one point, a normal parathyroid was found. The substance of the tumor was made up of broad strands, and masses of epithelial cells, resembling those of a normal parathyroid. The protoplasm of these cells was slightly tinged, and the nuclei were vesicular. Toward the stroma of connective tissue, almost everywhere, there was found a row of palisade cells with nuclei that stained more deeply. Occasional colloid droplets were seen. There were no metastases from this tumor, and the patient recovered.

Erdheim (Ziegler's Beitrage, xxxiii, 1903, p. 158), while making an autopsy on a person eighteen and a half years of age (sex not stated), discovered a nodule at the lower pole of the thyroid gland, which was not definitely connected with the gland. It was supposed to be parathyroid, and no other parathyroid could be found. The nodule was 2.5 cm. in length, and 1.5 cm. in width. It was found to consist of strands and irregular masses of epithelial cells, the vascular supply in the delicate stroma being relatively scanty. The cells corresponded with those of the normal parathyroid. Colloid droplets were found, but there were no definite follicles. In one of the sections, there was a cyst, which was lined with one layer of cells.

Erdheim suggests that, in view of the fact that the other parathyroids were absent, this enlargement might be regarded as the result of a work hypertrophy, which gave the impulse to tumor formation.

MacCallum (Johns Hopkins Hosp. Bull., xvi., 1905, p. 87) reports that he made an autopsy on a man twenty-six years of age, who, for several years, had presented symptoms of chronic nephritis, and on whom decapsulation of the kidneys had been performed at the Johns Hopkins Hospital. The patient died in uremia. MacCallum discovered, on the right side of the neck, a round, smooth mass, enclosed in a delicate capsule, and lying in the loose connective tissue. The mass was just below the lower pole of the thyroid, and quite separate from it. It was about 2 cm. in diameter, and almost spherical; and it was richly supplied with blood vessels. Two well formed and normal parathyroids were found. The thyroid was also normal. Microscopic examination showed that the mass was composed of a tissue that closely resembled normal parathyroid. There were strands and very large bunches of cells, which were separated by a relatively delicate stroma bearing blood vessels. Compared with the normal parathyroid, the blood supply was extremely scanty. The columns of cells were usually solid, the cells being packed together and pressed upon one another into polygonal forms. There was no colloid-like material in the cells or the alveolar spaces.

MacCallum says that the growth differed in no way from the normal parathyroid, except in bulk, in the size of the cell masses, and in the formation of definite cavities; and perhaps, also, in the fact that there was no adipose tissue between the cells. The same question arose here as was raised in Erdheim's case: Was this a tumor, or was the enlargement the result of compensatory hypertrophy? In view of the fact that two other normal parathyroids were found, the only method of reasoning that would cause one to believe that this was a work hypertrophy would be to assume that the renal insufficiency had made extra demands upon the parathyroids. MacCallum, however, does not regard this condition as compensatory hypertrophy. He looks upon it as an adenomatous growth.

Goris (Jour. de Chir. et Ann. de la Soc. de Chir., 1905, p. 594) reports the case of a man

twenty-two years of age from whom he had removed a tumor consisting of three cysts. These three cysts were closely connected, but were independent of one another and also of the thyroid gland. They were very adherent, and consisted of encapsuled colloid matter and degenerated parathyroid tissue. Examination showed that the condition was one of cystic degeneration of the parathyroid lobules. The patient recovered.

Hulst (Centr. f. allgem., Path. u. path., Anat. xvi, 1905, p. 103) reports that in an autopsy on a very old man who had died as the result of an accident, he found that the thyroid gland had undergone senile atrophy, and that on the right side there was a tumor of the parathyroid. The tumor was almost round, 2.5 cm. in length, 2.5 cm. in breadth, and 2 cm. in thickness. It was hard to the touch, and was covered with a distinct capsule of connective tissue. On section, it exhibited a brownish yellow color, resembling that of the suprarenal gland. Further examination of the body showed that there was, in the apex of the left lung, a tumor mass, which proved to be a primary adenocarcinoma; but which bore no relation whatever to the parathyroid condition. The parathyroid tumor was prepared in the usual manner, and sections were cut. It was found to be divided into separate nests of cells by a distinct thin septum of connective tissue. These cells were frequently polygonal in shape, showing fine granular protoplasm with nuclei that bore a distinct relation to the size of the cell. The nuclei were found either directly in the middle of the cell or to one side of the median line. Some of them were clear, and some were dark. The cell boundaries were usually sharp; and at times there was a palisade arrangement of the cells. Karyokinetic figures were absent, except where there had apparently been local disturbance of circulation; and in such areas the figures were well marked. The connective-tissue septa were distinctly sclerotic, and contained few nuclei. Small drops of colloid material were seen between the cells and among the capillaries.

The author is convinced that this is a tumor of the parathyroid gland. The new growth is nonmalignant, and its structure clearly resembles that of the normal parathyroid tissue. The question was raised in this case, also, as to whether the growth was a simple hypertrophy or a distinct adenoma.

Weichselsbaum (Verhandl. d. Deut. path. Gesells., 1906-7, ix, u. x, p. 83) reports that, while making an autopsy on a woman who had died of pneumonia, he found a distinct tumor of the left upper parathyroid gland. This tumor was 4.3 cm. in length, 3.6 cm. in width, and from $\frac{1}{2}$ to one cm. thick. It was soft, movable, and reddish gray, and presented no evidence of malignancy. It had a distinct connective-tissue capsule, and four separate kinds of cells were present. The first variety of cells closely resembled those found in normal parathyroid tissue. The second suggested the oxyphile cells of the normal parathyroid. The cells of the third group made aggregations with a central lumen, around which the cells were radially arranged. In the fourth variety were classed those cell groups that were not plainly separable one from the other, nor from the stroma of the tumor.

The question arose here, as in previous cases, as to whether this growth was an adenoma or a work hypertrophy. In view of the absence of fatty tissue, the author inclines to the opinion that the case was one of adenoma, bearing in mind, however, that the border line between adenoma and hyperplasia is not sharply defined.

In the discussion upon Weichselsbaum's paper, Askanazy stated that in a case of ostitis deformans he had found a tumor involving the parathyroid gland, and that it opened the question as to whether or not there was a relation between the affection of the parathyroid gland and the bone disease with which the patient suffered.

There have been seven cases of parathyroid tumor reported, and mine makes the eighth case. Five of these were found at autopsy. Three of them, the cases of Benjamin, Goris, and Da Costa, were removed by operation, and were subsequently discovered to be parathyroid tumors. In one of these cases the tumor removed by operation, was found to be in a state of cystic degeneration. In one, it is merely stated that the growth was parathyroidal in its nature. In my case, the growth was either adenoma or work hypertrophy. All

the three patients operated upon recovered. In four of the five cases discovered at autopsy; it was doubtful whether the condition was adenoma or work hypertrophy and in one case the nature of the parathyroidal growth was not stated.

SUBSEQUENT HISTORY OF MY PATIENT

For a number of months after the operation, the patient upon whom I operated was perfectly well; but about a year subsequent to the operation, she noticed some enlargement of the left side of the neck. This enlargement has slowly, but certainly, increased. I have examined her within a month. She has a mass on the left side of the neck, corresponding exactly with the mass that I removed from the right side. It is now about the size of a walnut.

Whether this enlargement on the left side of the neck is an enlargement of the left lobe of the thyroid or is an enlargement of the parathyroid of the opposite side, I am unable to state. The operation removed the right lobe of the thyroid gland and the lower right parathyroid, which was the seat of the tumor formation. Careful examination failed to discover the other right parathyroid connected with the mass removed; and, of course, there may have been no right upper parathyroid in this patient. It seems to me that the probable inference is that the original enlargement was a work hypertrophy; and that, now that the enlarged parathyroid has been removed, the structure of the opposite side is undergoing a similar enlargement. This enlargement, in all probability, has taken place under what John Hunter called "the stimulus of necessity"; but what may be the nature of the demand that constitutes this necessity is, I have not the faintest idea.

This patient has had no nervous symptoms whatever. The obvious conclusion of the whole matter is that both the surgeon and the patient must have been blessed with peculiarly attentive guardian angels, because tetany has not arisen. I am entirely unwilling to attempt a surgical operation upon the mass on the left side of the neck.

FRACTURE OF THE ASTRAGALUS

By J. H. STEALY, Freeport, Illinois

I WAS prompted by the apparent dearth of the literature, especially here in America, upon fractures of the astragalus, to investigate the subject. After consulting my own library, with the result of finding scarcely more than mere mention of astragaloid fractures, I resolved to go deeper into the literature with the result that I have consulted 256 authors.

Gaupp of Berlin in 1894 attempted to compile the literature of astragaloid fractures and he found only 59 cases.

By the able assistance of Dr. Carl H. von Klein of Chicago, we have compiled all the literature upon astragaloid fractures, with complete bibliography, which will be given in the publication of this paper.

Astragalus, talus, or knuckle-bone (with which the ancients used to play at dice) is the keystone of the arch of the foot. It supports the whole weight of the body, which in the erect position falls perpendicularly upon it from the tibia. It is so much concerned in the mechanism of the spring of the foot that the Germans call it the "spring bone."

ANATOMY

The ankle joint is a ginglymoid joint formed by the lower end of the tibia with its malleolus and the external malleolus of the fibula, with the upper surface and side of the astragalus. Its ligaments are: First, the anterior, connecting the articular margins of the tibia and fibula with the rough upper surface of the astragalus; second, posterior ligament, which is thin and imperfect, extending between the external malleolus, back of the lower end of the tibia, and the posterior tibiofibular ligament above and the posterior surface of the astragalus, from one lateral ligament to the other below; third, the internal lateral ligament radiates from the lower border of the inner malleolus to the

astragalus behind and below, in front to the scaphoid, and passes almost perpendicularly to the os calcis; fourth, the external lateral ligaments composed of three fasciculi from anterior margin to apex, and back of external malleolus, is attached to the astragalus and os calcis.

Nerves, internal saphenous and anterior tibial, arteries anterior and posterior tibial, anterior and posterior peroneal.

It has six aspects: Superior, lateral, posterior, anterior, inferior, and tunnel of the tarsus.

Superior Aspect. Is broad and horizontal in the transverse direction, presenting a pulley-like convexity in the anteroposterior direction. This articulates with the tibia and admits dislocation of the astragalus backward.

Lateral Aspect. Presents an articular surface adapted to the corresponding malleolus. The outer is larger and slightly concave and triangular. The inner is small and occupies but little of the bone.

Posterior Aspect. Is narrow and presents a groove running obliquely downward and inward for the tendon of the flexor longus pollicis. Has a projection on the outer side of it for the attachment of the posterior division of the external lateral ligament of the ankle.

Anterior Aspect. Presents a large convex "head" on a socket formed by the scaphoid, below by the sustentaculem tali (part of the os calcis), also by a strong elastic ligament which fills up the gap left between these bones. In children the under surface of the "head" has two separate "facets" to articulate with the os calcis. In adults they become united. It is this ligament (calcaneoscaphoid) which mainly supports the arch of the foot and gives it spring.

Inferior Aspect. This rests on the os calcis by two articular surfaces; of these surfaces the posterior is by far the larger and placed a little more external than anterior. In stepping forward the bones (os calcis and scaphoid) roll easily below the astragalus, that the toes may suit the inequalities of the ground.

Tunnel of the Tarsus. The groove just mentioned corresponds with another between those of the os calcis. When the bones are together the two grooves form a perfect tunnel (canalis tarsi) beneath the astragalus.

ETIOLOGY, ORIGIN, AND THE MECHANISM OF FRACTURES OF THE ASTRAGALUS

The observation of fractures of the astragalus as an isolated injury is of modern date. Where the subject has been discussed in detail, the credit may usually be given to the German authors.

It requires an enormous force to produce a fracture of the astragalus. It naturally follows that the victim will usually be numbered among the laboring classes.

Statistics show that the majority of cases are men; masons, carpenters, painters, and roofers, all whose work calls them to high places.

The assertion of some authorities that fractures of tarsal bones seldom occur under the 40th year of age does not hold good with the astragalus. Age has but little influence upon the frequency of this accident, except in children and the aged.

The principal cause of the talus fracture is a fall from a height upon the feet.

It is remarkable that the higher the fall the lower the fracture is situated. A very high falls splits the calcaneum, less high, the astragalus, and a medium, the bones of the leg.

As to the mechanism of the force required, the formation and laceration of the talus would indicate the necessity of a complicated force to effect fracture. So long as it is intact the under surface of the talus is against the upper surface of the calcaneum and has but little movement. If the force is very considerable it will either rupture the connective apparatus (when there will arise distortion or dislocation) or else the short, stiff connections hold their own, and the bone is broken. In the latter case there may or may not be dislocation of the fragment.

The malleoli are broken in this way, and it is possible for an enforcement of the normal movement to effect a fracture. Rundeau reports a fracture of the neck of the astragalus by direct cause. These fractures by direct cause are very rare.

Malgaigne in his "Treatise of Fractures and Luxations" does not report a single case.

Leon Labbe says: "Fractures of the astragalus are usually accompanied by considerable damage to surrounding bones, and it is rarely treated as the principal.

If the violence is not exhausted by the fracture, the displacement of the inferior fragment takes place. Then there results deformties of the foot and complications which are observed in dislocations of the talus. If a fracture of the neck, the head may keep its place while the body alone is displaced.

H. Fischer says: "The fracture of the sustentaculum tali arises through the forced extension with adduction of the foot. The foot is in varus-position and the heel is shortened,

this latter through a pushing forward of the calcaneum.

L. Ombredanne made 42 experiments upon cadavers, with the following conclusions:

1. The outline of fracture is always obliquely downward and backward.

2. It commences above, then upon the neck, then upon the anterior or the trochlea, then at 12 mm. of the border of the trochlea.

3. It always terminates at anterior surface of the border or pulley in the articulating posterior surface of the inferior surface of the astragalus.

4. The anterior fragment is always by the ligament.

The astragalus never fractures but in the flexions of the foot upon the leg, a simple flexion or combination with the torsion of the foot inwards or outwards.

In extension, the vertical shock gives dislocation forwards.

Tilleaux says that the simple movements abduction and adduction fracture the malleoli.

The direct fracture of the talus by crushing is rare.

The individual break by crushing exists as a primitive lesion and is quite exceptional.

Fractures of the astragalus are observed: 1. By tearing transversely the neck and the body, sagittal of the body of the posterior tubercle; 2. By crushing, very rare if they exist.

Fractures of the neck and body with dislocation of fragment should be treated at once by its removal. Fractures of the posterior tubercle often leave an achillodynia, and its extirpation is advised.

Nunnely reports a case, 15 months before, receiving an injury with great swelling of the ankle joint and very painful. Fragments of bone were easily palpated. Diagnosis was a comminuted fracture of the talus. Amputation was made in the under triangle of the ankle. The specimen showed an isolated fracture.

G. W. Norris says dislocations treated in 20 years from 1830–1850 at Pennsylvania Hospital, there was only one case of dislocation and fracture of the astragalus out of 177 cases.

Radiograph demonstrated that the two borders of the pulley of the astragalus were not on the same plane, that the trabeculation was changed with a serious fracture of the astragalus reaching to the articulation. Patient would not consent to an operation, preferring the ankylosis.

Destol says this fracture may be divided into combined and isolated. The combined fracture is the fracture of the astragalus associated with a fracture of either malleolus or os calcis. Among the five types of fractures, two alone indicate intervention: 1. The astragalo-malleoli fracture, successfully treated by resection of tibio-tarsal; 2. The fracture complicated with a lesion of the scaphoid, reclaimed by immediate intervention.

In fracture of the astragalus we have a class of symptoms so similar to sprained ankle or fracture of the malleoli or os calcis, or other tarsal bones, that the expert may fail to make a diagnosis without the use of an X-ray, and then, not always positive until a radiograph has been made.

J. Louis in his conclusions gives a classification of varieties of conditions to be considered as to conservative and surgical treatment.

No surgeon should venture a positive opinion of diagnosis, without calling in the aid of an X-ray. If he does, he will find his diagnosis frequently reversed.

Sedillat's case shows a fair example of the conservating surgery. The tibia and astragalus were broken. The latter bone was dislocated outward and was irreducible. Gangrene seemed imminent and amputation the only resource, but removal of the astragalus accomplished the complete recovery.

Fractures of the sustentaculum tali are produced by forced extension, with adduction of the foot.

Hummer distinguishes fractures of astragalus as follows: 1. Column fracture (most frequent); 2. Horizontal fractures; 3. Saggital fractures; 4. Diagonal fractures; 5. Split fractures; 6. Fracture of the back apophysis.

The apophysis posterior breaks itself outward by a special mechanism; that is by avulsion or, in fact, by partial inflection, but varies from the true inflection by certain characteristics peculiar to that part of the bone.

Chassaignac reports a patient who had fallen from the fifth story to the ground upon both feet. Left foot presented dislocation of the

astragalus with multiple fracture of the bone. The right foot presented a luxation of the astragalus and offered the following aspect: An enforcement of the astragalus into the first row of the tarsus, foot everted, an abrupt prominence at the inferior end of the tibia. The astragalus had gone through a vertical resolution. The tendons of the long flexors of toe had passed under the head of the astragalus.

J. L. Thomas reports a rare fracture through the neck of the talus; the body dislocated backward, the trochlear surface being in contact with the tendo-Achilles. No formation of bone in the gap between the neck and displaced body of the talus.

E. H. Bennett says occasionally an ossicle is found in the posterior of the astragalus. An intermedium tarsi, or os trigonum tarsi are the names applied to supposed homologue of this bit of bone in certain of the lower members of the class mammalia. The question is, is this piece of bone to be regarded as separate from the astragalus because of fracture, or is it a distinct bone, or rudiment of bone, or apophysis? It has been held that in the talus there is only one ossific center; viz., in the body of the bone.

The author was amputating the malignantly diseased foot of a middle-aged woman. Was cutting the external lateral ligament, when a loose piece of bone appeared; turned it upon the floor for examination later. It was quite detached from the astragalus. The woman's foot had been injured several years before. Seemed to confirm theory of fracture of the tubercle of the astragalus (par arrachement) by being torn.

Bliesener reports the following out of 26 cases of fracture of the astragalus and os calcis, which he divides as follows: First case, age 17 years, isolated fracture of talus. Two cases, ages 33 and 26 years, isolated fracture of os calcis. Four cases, ages 18, 40, 49, 17, fracture of talus and malleoli. One case, age 19. fracture of calcaneum and malleoli. Eight cases, ages 28, 21, 21, 41, 19, 30, 23, 33, fracture of talus and calcaneum. Ten cases, ages 44, 43, 34, 35, 25, 26, 22, 36, 54, 59, fracture of talus calcaneum and malleoli.

FREQUENCY OF FRACTURE

Norris reported 2,190 cases of fractured bones of the human body in twenty years at the Pennsylvania Hospital, and only two cases were fractures of the talus and one, of the os calcis.

Gruett, on the contrary, estimates these fractures to be 2 per cent of all the fractures of the human body.

J. E. Erickson says he has seen only two cases of fracture of the astragalus without implication of other tarsal bones. One case, result of direct violence, a cart wheel passed over the foot fracturing the neck of the astragalus. *In the other case*, result of indirect violence, the foot was driven up into the malleolar arch and the astragalus was broken transversely in front of the surface that articulates with the tibia.

Moelland reports a horizontal fracture of the astragalus. Patient fell from a ladder striking upon the sole of the foot and then falling forward upon his face, the foot in consequence being strongly flexed upon the leg. Soon after there was considerable swelling of the foot; unable to stand. Flexion and extension of the foot was absolutely impossible and lateral movement much diminished. Swelling on each side of tendo-Achilles indicated fracture of the astragalus. There was a slight obliquity which disappeared when the foot was normal. Horizontal astragalus fractures are rare.

Clark (LeGros) reports a case: A man was thrown from a horse. Deformity not marked, neither eversion nor inversion. Tendo-Achilles was not tense, but a hard prominence was between the inner malleolus and the os calcis, over which the drawn skin threatened to break. Internal malleolus intact, but fibula broken above the ankle. Reduction could not be effected, but recovery took place. It appears possible that the neck of the astragalus was fractured and the head still remained in relation to the scaphoid.

Destol reports the observation of 22 cases of fractures of the astragalus, and only four cases of luxation of that bone. Some were isolated fractures and some were combined with fracture of the other bones. Pain and functional impotency denote their presence.

In all these cases they have been extracted, when fragments were dislocated and palpable through the skin. In the isolated cases use was made of various mechanisms. Destol relates a case: A man fell 80 cm., struck a large stone and turned his foot. Heard a cracking, and was unable to arise. Swelling and ecchymosis resulted but no fracture suspected. Treated for five months as a sprain. The patient then walked with difficulty and upon outside of the foot.

Symptoms. Desfosses (G). Symptoms of the fracture of the astragalus: To walk or to stand is impossible after a fracture of the astragalus. The foot is placed in extension. It presents a swelling at the surface of the astragalus neck. This swelling causes the disappearance of the depressions which exist at each side of the tendon Achilles, and it hides the malleolar prominences. Pain is acute at the time of the injury. Afterwards it varies according to the susceptibilities of individuals. It is excited by pressure above the neck or above the malleoli. The enlargement of the neck depends, no doubt, upon the separation of the fragments of the astragalus and their maximum position to the inferior surface of the malleoli.

Gaupp (R). Aside from the severe pain, always present at the moment of injury, the region of the ankle shows great swelling. This is caused by the sudden influx of the blood. The contour of the malleoli and tendo-Achilles is usually effaced. In certain cases there is a bony prominence. Ecchymosis is the rule. The position of the foot varies. In some cases it keeps its normal position and shape.

Fracture of the talus-neck without fragment dislocation. Varus-position is very frequent. Also the shortening of the inner border of the foot, which is turned upwards. Foot is usually deformed. The malleoli are pushed in deeper. The arch is flattened. If the talus is crushed from the side, one fragment is sunk deeper. The most important symptom is when the fracture is dislocated and one fragment is seen and felt under the skin.

Diagnosis 1. Molliere says, regarding fracture of the astragalus, we have these factors:

1. That the astragalus is often fractured at the surface of its neck.

2. That the anterior parts alone are displaced.

3. That one of the symptoms of that fracture is the shortening of the internal border of the foot.

4. That the prognosis must be reserved, because later it may produce a case of varus.

5. That abnormality may be corrected by section of the tendon Achilles, by massage, and by use of apparatus.

6. That the fracture of the astragalus *without wound* may have as a consequence the suppuration of the tibio-tarsal articulation; when the fragments lose all their vascular connection they are subject to necrosis.

Gaupp (R). When the fracture of the astragalus is complicated with a wound, the diagnosis, as a rule, is easy to make. Sometimes the dislocated fragment is visible or the finger can find it. In one case of complicated fracture the diagnosis was wrongly made in life, and only discovered at the autopsy. The surface or corner of a dislocated fragment can often be felt under the stretched skin. It has been stated that there is sometimes a spontaneous movement in the talo-crusal joint, immediately after the injury, which is entirely wanting in simple dislocation.

When the fragments are not dislocated the diagnosis is difficult. Abnormal sideway movement, and distinct crepitus may indicate this break. Sometimes the line of fracture can be felt under the skin.

Gaupp (R) says, regarding the subcutaneous fracture of the astragalus, after an investigation has been made and it is found that the fracture is not dislocated, rest and careful immobility of the member is all that is necessary.

The bandage must have all pressure in a right angle position of the foot to the ankle; as in case of anchylosis, this position is the most favorable. A light compress on both sides under the malleoli in arranging the bandage, will conduce to form and movement. Bandages should remain until there is perfect consolidation of the talus.

But if the investigation discloses dislocation of the fragments, or of one, the patient should have an anæsthetic and reduction be essayed.

In the minority of cases this will succeed. If reduction is impossible, operation as soon

as possible, as the stretched skin is in danger of suppuration. Usually there must be extraction of the fractured pieces of the astragalus, as the impossibility of reduction would indicate that the normal connections were ruptured.

I have been able to tabulate the cases as given in the literature as follows:

122 were isolated fractures of the astragalus.

68 were combined fractures involving other bones.

48 were compound fractures.

8 were direct fractures.

The head of the astragalus was extirpated in 19 cases. The body of the astragalus was dislocated and extirpated in 31 cases. The whole astragalus was removed in 8 cases. The foot was amputated in 8 cases, and in one case both feet were amputated. Either malleoli was fractured in 11 cases; in 2 cases both malleoli were fractured. The os calcis was fractured in 15 cases; in two patients the os calcis was completely removed. Twenty-four patients succumbed to septicæmia, eight of these were classed in the isolated cases due to pressure necrosis. The kind of fractures in the remaining cases is not given.

Treatment. M. Olliver, of Lyons, has practiced 86 astragalectomies. This operation has been robbed of its mortality and has given excellent results.

M. Loyson, of Lyons, has made 22 astragalectomies without a single death. The therapeutic results have been excellent; most of the patients have conserved the movement of extension and flexion. Some of them have been able to walk as far as 25 kilometers (15 miles) in one day, all these operations, of course, being made under the shield of modern antiseptic methods.

Before these antiseptic precautions were taken the mortality in operative cases was much greater.

R. H. Reed says fracture of the astragalus is uncommon, for, owing to its peculiar situation, it enjoys a greater immunity from injury than almost any of the tarsal bones. When fractured, the reduction of the displaced fragment is difficult, almost impossible.

Reed's conclusions: 1. Reduction is the rare exception and not the rule. 2. Total failure to reduce the fragment is the general rule. 3. That these cases may get well with a fairly good and useful ankle by following a conservative treatment. 4. That a conservative line of treatment may have a disastrous result. 5. That a fair degree of recovery may follow the excision of the dislocated fragment. 6. That destructive inflammation of the remaining portion of the astragalus may follow with necrosis, necessitating its ultimate removal. 7. That a fracture of this class is almost invariably followed by a permanent and irreparable injury. For if resolution follows without an operation, there is a deformity with associated disability, or if the entire talus is removed as some authorities advise, there is still a more or less fixed disability.

Personal Cases. I here show you some skiagraphs taken of my cases.

CASE 1. Showing conditions before removal of fragment, and 4½ months after. A male 30 years of age, manager of a creamery, ascended a ladder for about ten feet, while adjusting some wiring at a chimney. The ladder slipped, he falling, with the left foot caught in the rounds of the ladder in such a manner as to produce extreme extension of the foot, causing an oblique, downward, backward, and outward fracture of the astragalus (with a backward and outward displacement of its body). No exterior wound. The fragment was twisted and turned up so the articular surface lay beneath the tendon Achilles, the head remaining in place.

The patient was brought to me during the fourth week after the accident, and after several attempts by as many physicians had failed at reduction. I made a curved incision from in front at the outer astragaloscaphoid articulation backward one-half inch beneath the external malleolus to the tendon Achilles. By using care I was able to reach the important structure, and separating the fasciculi of the external ligament, thus avoided the tendons, nerves, and arteries. Getting down to the dislocated body, which was practically loose of all ligamentous attachments, I grasped it with a heavy bone forceps and was unable to replace it; so I concluded it would act as a foreign body and should be removed, for being free from its nutrient supply it would necrose. I excised the external malleolus and the cartilage of the tibia, as well as that of the os calcis. I shoved the os calcis up against the tibia and closed the wound, with the exception of a small gauze drain. The foot was put up in plaster and not redressed for two weeks. The patient left the hospital at the end of the fourth week, putting some weight upon the foot. Three and a half months afterward I wrote to him to come and see me, as I wished another skiagraph. He was then using a cane. I had him discard the cane. The function of the joint is almost perfect. He has been hard at work since leaving the hospital. He still

Fig. 1. Fracture of neck of the astragalus with posterior dislocation of body.

favors the foot slightly, but I believe that within one year from receipt of accident he will walk without a limp. The foot is not in varus and the leg is but slightly short, and, by the use of an additional sole on the shoe, it will never be noticed. (Fig. 1-4.)

Fig. 2. Skiagraph taken four and one-half months after removal of astragalus.

Fig. 3. Photograph of the body of the astragalus after removal.

CASE 2. A physician of our city, while serving as assistant surgeon in the United States Army in Cuba, was upon a high platform. Feeling that the sub-structure

Fig. 4. Anteroposterior view taken four and one-half months after removal of astragalus.

Fig. 5. Fracture of the posterior apophylsis of the astragalus.

was giving way, he jumped down to a brick pavement, a distance of 18 feet, alighting upon his feet and sustaining a severe injury of the tarsal bones, with pain and swelling back of the malleoli and up the calf of the leg. He was around on crutches for six weeks; was treated expectantly. A radiograph taken recently, which I here show you, presents a fracture through the groove of the astragalus for the flexor longus hallucis, with what appears to be a bony ankylosis, causing limited movements of the ankle joint with a moderate degree of varus. (Fig. 5.)

CONCLUSIONS

1. Where an injury to the ankle joint has been sustained, producing great pain and swelling, a diagnosis should be made.

2. Do not expect to make a correct diagnosis of the injuries of the astragalus, without calling into service the X-ray with radiographs of the parts.

3. Do not make a diagnosis and attempt at reduction of astragaloid fractures with dislocation, before a radiograph has been taken, nor without an anæsthetic.

4. Take into consideration the manner in which the injury was sustained.

5. Remember reduction of dislocated fragment is almost always impossible.

6. Do not make yourself believe these conditions will in time correct themselves, and come out with a functionally good ankle joint. They won't.

7. Remember the dislocated fragment is liable to necrosis.

8. That destructive inflammation with suppuration may follow.

9. That generally, soon as expedient after a proper diagnosis has been made, the dislocated fragment should be extirpated.

10. That the operation should be done through one incision, expeditiously, and without destruction of important tissues as nerves, tendons, and arteries. Thus giving a far more useful member than if left to nature.

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TENOSYNOVITIS OF THE HAND[1]

A Clinical, Experimental, and Anatomical Study

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Introduction and Scope

The accompanying contribution to the subject of infections of the hand is the third of a series dealing with this subject. The first, upon "Acute Phlegmons of the Fascial Spaces," appeared in Surgery, Gynecology and Obstetrics, September, 1905; the second, upon "Chronic Suppurative Processes of the Hand," appeared in the same publication, November, 1907. In addition to the present contribution, there still remains the subject of "Lymphatic Infections" to be dealt with, which I hope to present at a subsequent period. The present article deals with "Acute Infections of the Tendon Sheaths of the Hand and their Sequelæ." I have referred to the two previous articles in various places so as to avoid useless repetition.

I have not attempted to discuss the chronic inflammatory processes, such as tuberculosis, but have confined myself strictly to the discussion of acute inflammatory processes in the sheaths. Owing to the length of this contribution I shall not include a complete report of my cases, but will reserve that for a future time.

1. Historical.
2. Anatomy.
   I. Dorsal sheaths.
   II. Palmar sheaths.
      (1) The sheaths of the index, middle, and ring fingers.
      (2) The tendon sheath of the flexor longus pollicis.
      (3) The ulnar bursa.
      (4) The intercommunication of the sheaths.
3. Pathogenesis — Source of involvement of the sheaths.
4. Pathology.
   I. Primary.
   II. Secondary.
5. Diagnosis, Symptoms, and Course.
   I. Infections beginning in the little finger.
      (1) Extension to the ulnar bursa.
      (2) Extension to the radial bursa.
      (3) Extension to the forearm.
   II. Infection beginning in the index, middle, and ring fingers.
   III. Infection beginning in the thumb.
   IV. Differential diagnosis.
6. Treatment.— Methods of Bier, Klapp, Forssell, Heineck, Sheide, Schüller, Tilleaux, Koenig, Lexer, Tillmans, Friedrich, Mauclaire, Lejars, Helferich Schleich, Poulsen, Nicaise.
   I. While diagnosis is in doubt.
   II. After diagnosis is made.
      (1) Treatment of index, middle, and ring fingers.
         1. Tenosynovitis proper.
         2. Extensions from these three fingers.
      (2) Treatment of little finger and ulnar bursa.
         1. Little finger.
         2. Ulnar bursa proper.
         3. Extensions from the little finger and ulnar bursa.
      (3) Treatment of the tendon sheath of the long flexor of the thumb.
      (4) Synovial sheaths upon the dorsum.
   III. After treatment.
7. Résumé.

Historical

THE study of infections of the hand has been of interest to surgeons from the earliest times. Professor Albert[2] says that while the word panaritium was not used by Celsus, it is found in the Arabian however, and other ancient writings, and appears to be a corruption of the Greek *παρονγιά* (*παρά ὄνυξ*); Paracelsus, Dorneus and others have used the words, Pandalitium, Passa, Panaris, and Panarium and it cannot be said whether these refer to different types or are corruptions of the same word. Concerning the elemental meaning of Panaritium, Forestus[3] states "Panaritium s. Paronychia tumor edicitur, calidus, ulcerosus, summe dolorosus, accidens in summitate digitorum in latere unguis et: quandoque tam vehementer afficiens, ut vigilias et inquietudinem excitet."

In later times the greatest interest in the history of tenosynovitis centers about the time of Dolbeau and his pupil Chevalet. The latter wrote an extensive monograph[4] concerning the deep phlegmons of the hand and forearm and maintained that they were due to lymphangitis, while Gosselin and his pupil Schwartz with most other surgeons asserted that they were due to rupture of the synovial sheaths. Duplay[5] thought that there was an

[2] Chir. ii, 1885.
[3] Chir. Lib. V. Observat. 16.
[4] Thèse pour le doctorat en Médecine, Paris, 1875.
[5] Phlegmons de la main, Progrès méd. August, 1879.

[1] I wish to acknowledge my appreciation of the kindness of Dr. B. C. Cushway in taking the X-ray photographs, and to Dr. Mortimer Frank for assistance in their preparation. I am also indebted to Dr. Aimé Paul Heineck for many courtesies in the use of his material and assistance. Several of the photographs of patients were kindly made for me by Mr. Buchbinder.

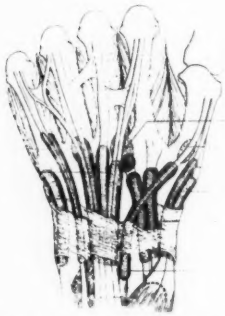


Fig. 1. (Poirier). Drawing showing the tendons on the back of the wrist.

early lymphangitis which led to a synovitis and this ruptured causing an extension to the surrounding tissue.

E. Schwartz[1] believed that the lymph vessels could be at fault but that in the greatest number of cases the synovial sheaths played the greatest rôle. Previous to this time, the great interest in infections of the hand had culminated in the publication of a book by Bauchet[2] which, while a résumé of what was already known, added little to our knowledge. Later a carefully observed series of cases was reported from the Griefswald Clinic by Max Tornier,[3] who brought prominently before the profession Helferich's method of widely opening the sheaths which was later substantiated and discussed with carefully observed cases by Forssell.[4]

From these authors, and especially Forssell I wish to make acknowledgment of abstracts which I have taken freely.

Anatomy

Sheaths upon the dorsum

The synovial sheaths of the hand upon the dorsum, are six in number. These begin just above the posterior annular ligament and pass under and through it (see Fig. 1). They are found as follows:

1. Lying upon the outer side of the styloid process of the radius, for the extensor ossis metacarpi pollicis and the extensor brevis pollicis. These may have separate sheaths and are 5–6 cm. in length.

2. Behind the styloid process, for the tendons of the extensor carpi radialis longior and brevior. These are 5–6 cm. in length and communicate with the sheath of the extensor longus pollicis through an oval opening by way of the longior. (Poirier.)

3. Overlapping the above tendons and communicating with them as described, we have the sheath of the extensor longus pollicis. This is 6–7 cm. in length.

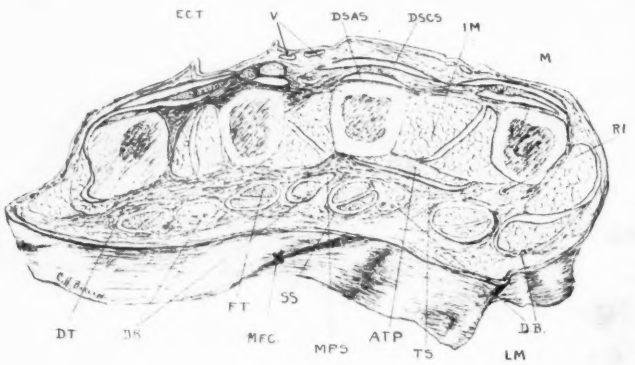


Fig. 2. Cross section, 1 cm. proximal to the metacarpo-phalangeal joint showing the tendon sheaths around the tendons (SS) and the spaces around the lumbrical muscles (DB).

[1] Recherches anatomiques et cliniques sur les gaines synoviales de la face palmaire de la main, These de Paris, 1878.

[2] Du Panaris, L. J. Bauchet, Paris, 1859.

[3] Beitrag zur Kenntnis schwerer Phlegmonen, Inaugural Dissertation, Griefswald, 1891.

[4] Klinische Beiträge zur Kenntnis der akut septischen Eiterungen de Schnenscheiden der Hohlhand besonders mit Bücksicht auf der Therapie, Nordisches Medizinisches Archiv., 1903, Abt. I, Heft 3.

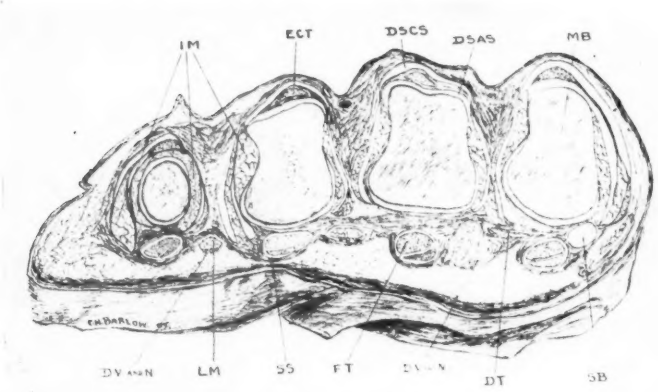


Fig. 3. Section just proximal to the metacarpo-phalangeal joint showing lumbrical spaces (LM) and synovial sheaths (SS).

4. To the ulnar side of this we find the large sheath inclosing the tendons of the extensor communis digitorum and the extensor indicis. It is 5–6 cm. in length and terminates below in three prolongations. The radial one encloses the communis tendon to the index finger and the extensor indicis, the middle, the communis tendon to the middle finger; the one on the ulnar side covers the tendons to the third and fourth fingers.

5. One opposite the interval between the radius and ulna, for the extensor minimi digiti. This is longer than the others, being 6–7 cm. in length. Covering the upper one third of the length of the third interosseous space, it may bifurcate below, following the two branches of the tendon.

6. Upon the back of the ulna, the synovial sheath of the tendon of the extensor carpi ulnaris. This is 4–5 cm. in length.

SHEATHS UPON THE FLEXOR SURFACE

From a surgical standpoint, the sheaths upon the flexor surface are the most important. The anatomy of these may be discussed under four heads: 1. The tendon sheaths for the index, middle, and ring fingers; 2. The tendon sheath for the thumb with its prolongation in the hand (radial bursa); 3. That for the little finger and its prolonga-

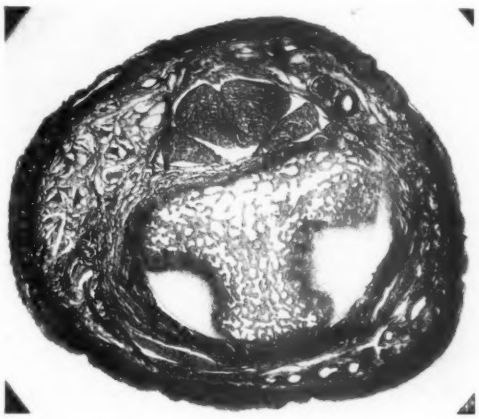


Fig. 4. Cross section through the epiphysis of the middle phalanx. Notice the loose mesh and small amount of tissue between the tendon and the bone.

Fig. 5. Longitudinal section of the distal phalanx and joint. Note the attachment of the tendon at the junction of the diaphysis and the epiphysis, and that the tissue of the distal portion of the phalanx is not in any sense connected with the tendon sheath.

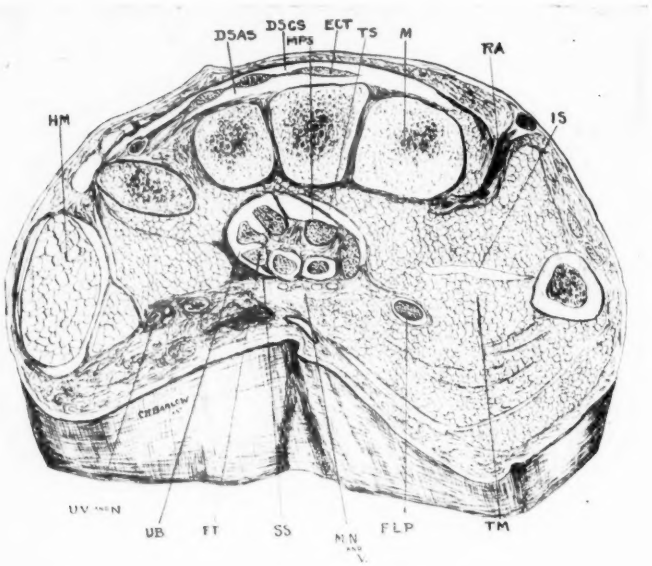


Fig. 6. Cross section through the base of the palm showing the tendon sheath of the flexor longus pollicis (FLP), the ulnar bursa (UB) and accessory synovial sacs of the superficial tendons.

tion in the palm (ulnar bursa); 4. The communications between these various sheaths.

1. The *sheaths of the index, middle, and ring fingers* begin just distal to the distal interphalangeal joint and extend into the palm, approximately a thumb's breadth proximal to the web; or the point of extension can be designated by drawing a line between the end of the proximal palmar crease as the base of the index finger and the end of the distal palmar crease at the base of the little finger. This line represents the approximate extension of these sheaths into the palm. It will be seen by noting Fig. 2 that at the distal portion of the palm there is a sheet of dense tissue inclosing the tendon sheaths and lumbrical muscles. The sheaths extend one-fourth inch proximal to this into the loose palmar tissue. This fact is of considerable importance from a surgical standpoint.

While passing through the dense tissue mentioned above, these sheaths have on either side the space called the lumbrical canal, through which pass the lumbrical muscles and digital branches of the arteries and nerves (Fig. 3). This is also of surgical importance.

As we pass distally, we find considerable tissue between the metacarpophalangeal joint and the sheath proper, while more distally as we come to the base of the proximal phalanx, we note that the sheath approaches the bone and is in close relation with the loose connective tissue going entirely around the bone. The surgical importance of this will be brought out later.

At the proximal interphalangeal joint, we find considerable tissue between the sheath and the joint, while over the base of the middle phalanx, i. e., at the epiphyseal line (Fig. 4) there is little or no tissue between the sheath and the bone. From this point distally, the relation to the bone is not so intimate. At the distal end the relation of the structures can be seen by studying Fig. 5.

I will not deal with the well known anatomical points which have no particular bearing on the subject in hand, such as the relation of the tendons to each other and to the sheath, except to draw attention to the fact that the sheath and tendon are covered by a synovial membrane which is exceedingly delicate and little resistant to infection.

These sheaths bear almost the same relation to the respective fingers. They do differ slightly in their relation to the palm of the hand as I pointed out in an earlier contribution.[1] The proximal end of the sheath for the index finger is in relation to the thenar space, while that of the middle finger is most often in relation to the middle palmar space, although at times it will allow of rupture into

[1] Surgery, Gynecology and Obstetrics, Sept., 1905.

the thenar space, possibly through rupture into the lumbrical space between the index and middle finger and thence into the thenar space. However, this lumbrical space itself most often leads into the middle palmar space. The tendon sheaths of the ring finger and of the little finger are in relation to the middle palmar space.

2. The *tendon sheath of the flexor longus pollicis* is of great importance from a surgical standpoint owing to the fact that in youth and adult life the sheath nearly always communicates with the enlarged sac of the tendon sheath at the wrist (19 in 20 cases, Poirier). The entire sheath has been given the name of radial bursa, although technically speaking it should be applied to only the proximal part at the wrist.

The sheath begins distally at the base of the distal phalanx and extends proximally a thumb's breadth proximal to the anterior annular ligament. It lies first in close proximity to the proximal phalanx, and at the distal end of the metacarpal bone becomes separated from the bone by the muscles of the thumb lying between the outer head of the flexor brevis pollicis and the adductor obliquus pollicis (see Fig. 6). At first it is somewhat superficial, but as it passes toward the wrist it lies more deeply. At times (1–20 Poirier) there is a separation of the sheath into two parts at about the middle of the metacarpal bone. This is frequently only a thin diaphragm. The sheath is generally well separated by connective tissue from the metacarpophalangeal joint and an infection may spread from the joint to the sheath or vice versa, but either is uncommon. It lies superficial to the proximal end of the thenar space, in juxtaposition to the flexor tendons in the carpal canal (see Fig. 7) and passes upward to terminate about an inch above the annular ligament by a rounded cul-de-sac extending under the deep surface of the tendon, corresponding to the radiocarpal joint and the lower end of the radius, lying on the pronator quadratus.

The communication between this and the ulnar bursa will be discussed later. The motor nerve to the thenar muscles lies within a finger's breadth distal to the annular ligament and superficial to the sheath.[1]

3. *The ulnar bursa.* The tendon sheath of the flexor tendons of the little finger communicates freely with the ulnar bursa in about one half of the cases according to Poirier, but statistics vary somewhat on this point. When

[1] Surgery, Gynecology and Obstetrics, Nov. 1906, A study of Chronic Suppurative Processes, page 537, under "Observations on the motor nerve of the thenar eminence, A study of 85 cadavers."

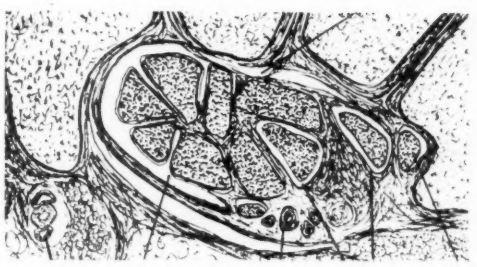


Fig. 7. Showing the relation of the tendons and synovial sheaths at the wrist. Note in this drawing the four pockets in the ulnar bursa instead of three as commonly described; also the tendon sheath of the flexor longus pollicis and the accessory synovial sheaths (SS). See text for description of the difference between the relations of the tendons shown in Figures 6 and 7.

the separation is present it is of any grade from a simple narrowing to a complete occlusion some millimeters in length. In these cases the sheath corresponds in length to those of the other fingers. Also the relations to the joints and spaces are the same except that there is no lumbrical canal upon the ulnar side of the proximal end. The sheath extends into the middle palmar space, and the lumbrical canal upon its radial side communicates with this same area. In this relation it should be remembered that these muscles do not lead into the thenar and middle palmar spaces directly but lie just superficial to them, in a loft, as it were, from which pus easily extends into the spaces.

The ulnar bursa proper (Fig. 8) begins at the proximal end of the finger sheath, spreads out rapidly and becomes a good sized sac overlapping the metacarpal of the ring finger and the head of the middle metacarpal, passes under the anterior annular ligament and extends a thumb's breadth above this, lying in relation to the lower end of the ulna and the ulnar side of the carpus and the radioulnar articulation, lying upon the pronator quadratus. It does not surround the tendons as a whole but lies to the ulnar side of the group of superficial and deep flexors and only envelops them as if they were pushed in along the outside. It follows, then, that the ulnar side of the sac is free while the radial side envelops the tendons, forming three spaces or arcades, as it were, the most superficial between the aponeurosis and the superficial tendons, the middle between the superficial and deep tendons, and the third between the deep tendons and the carpal canal (Fig. 6). These all open upon the ulnar side into a common space. This arrangement, first drawn attention to by Leguey, I believe, is in general true, but the arrange-

Fig. 8. An X-ray picture of a cadaver hand in which the tendon sheaths have been injected with red lead. The outline of the ulnar bursa and radial bursa with tendon prolongations is clearly shown. Note the distance of the radial bursa from the metacarpal bone of the thumb and the relation of the ulnar bursa to the metacarpal bone of the middle finger.

ment varies at different levels and in different individuals as can be seen by examining Fig. 7, where there are four pockets and none of them very deep. Moreover the tendons upon the radial side frequently have sheaths separate from the ulnar bursa as will be mentioned under our fourth caption, "The intercommunication of the sheaths." Attention should also be drawn to the fact that the superficial palmar arch with some of the unimportant branches of the ulnar nerve lie superficial to the sheath. More important, however, is the fact that the sheath overlies the middle palmar space making part of its roof, as it were (Fig. 9).

Fig. 9. Photograph showing relation of the middle palmar space to the tendons and their sheaths, i. e., the middle palmar space being dorsal to the tendons.

Above the anterior annular ligament it is well to note that the tendons of the palmaris longus and the flexor carpi radialis lie above the radial bursa and the interval between this and the ulnar bursa, and that by drawing the tendon of the flexor carpi radialis to the radial side one can come down directly upon the flexor longus pollicis and its sheath. Attention should likewise be drawn to the fact that the median nerve lies between the two bursæ and somewhat deeply.

4. *The intercommunication of the sheaths.* Poirier [1] discusses the communication between the bursæ as follows:

"The synovial sheaths of the palm have no communication with each other, and the authors cite in proof of this the case of Gosselin who had observed it only once. However, the result of my observation has been that this communication between the two important sheaths is very frequent in the adult. It is found in about half of the cases. The connection is made by a median synovial sheath which I will describe."

"Accessory synovial sacs. The writers call attention to the occasional existence of synovial sheaths in addition to the two large synovial sheaths, which they call accessory sheaths, and are found at times along the flexor tendons of the index finger. They lie between the ulnar and radial bursæ, being found especially along the deep tendon. My researches show that these synovial sheaths are two in number. They ought not to be called accessory since one of these is almost always present. I have named them the intermediary anterior and posterior palmar synovial sheaths.

"The intermediary posterior palmar sheath. This should be described as a normal sheath since one finds it about eight times out of ten. It lies between the carpal canal and the flexor profundus of the index finger and commences above the wrist at the edge of the radius. It spreads out at the level of the upper border of the semilunar bone and goes down more or less on the tendon of the flexor profundus, varying from 3 to 8 cm. To see it, it is necessary to cut transversely across the mass of muscles and tendons in the lower third of the forearm and turn the distal end down toward the fingers. It is by the intervention of this sheath that the ulnar and radial bursæ communicate ordinarily.

"The anterior intermediary palmar sheath. This is found in hardly half of the cases. Much smaller than the preceding, it is found placed between the superficial and deep tendons of the index finger

"Both of these appear later than the others and it is very rare to find them as completely organized. In general, their walls lack the moist glassiness characteristic of complete development."

It is said [2] also that the synovial sheaths of the ring, middle, and index fingers communicate exceptionally with the ulnar bursa; following their respective tendons, occurring in the order of frequency as the fingers are named above. Again attention should be drawn to the fact that the intermediary sheaths may differ from that type mentioned by Poirier. I have dissected one case in which the profundus tendons of the index and middle fingers had separate sheaths. Communicating with the ulnar bursa (see Fig. 6) at this level the anterior intermediary sheath was absent but 2 cm. higher up the sheath of the middle finger profundus had disappeared while the anterior and posterior intermediary sheaths were present (see Fig. 7). The communication here then would have taken place as follows: ulnar bursa, sheath about the middle finger profundus, sheath about the index finger profundus, or posterior intermediary sheath, and, in this case apparently, anterior intermediary sheath, to the radial bursa. It can be seen that in a fulminating type of infection, such as a streptococcus involvement, the process would

[1] P. Poirier et A. Charpy. Traité d'Anatomie Humaine. Tome ii, S. 189.

[2] Tillcau. Traité d'anatomie topographique.

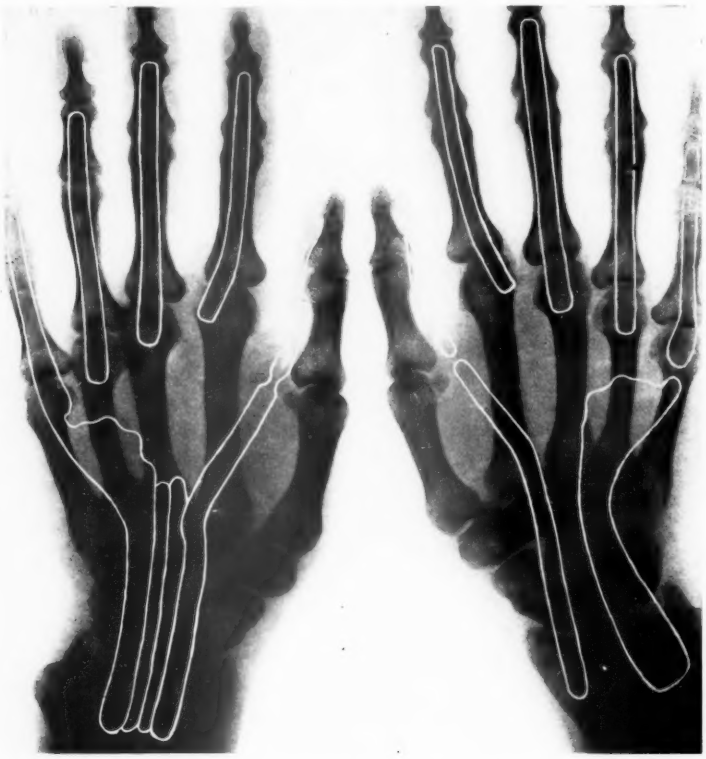


Fig. 10. Drawing made to show the relation of the tendon sheaths to each other and to the bones. The drawing upon the left shows that the tendon sheaths of the little finger and thumb are continuous with the ulnar bursa and radial bursa repectively. It also shows the accessory synovial sheaths between them. The drawing upon the right shows how the bursæ may be separated not alone from each other, but from their respective finger tendon sheaths. For other variations, see text.

spread to the radial bursa, but in the more chronic types this devious course offers many chances for adhesive occlusion of the channel. This will be discussed later (Fig. 10).

The relation of these synovial sheaths to the fascial spaces and to the wrist joint and the forearm will not be taken up here since it has been so extensively considered in earlier contributions to this subject.[1]

Pathogenesis — Source of Involvement of the Sheaths

Attention has been drawn above to the theories advanced by the earlier authors as to the source of infection of the sheaths. It is probable that they may be involved either by lymphatic extension or direct continuity. The latter, of course, needs no discussion. That wounds involving the sheath may be an atrium and that abscesses lying in contiguity may cause necrosis and involvement will be admitted by all. It is rather uncommon for a felon to give rise to tenosynovitis. The same may be said of suppurative arthritis of the distal interphalangeal joint, and the metacarpophalangeal joint. This is explained by the anatomical relations which also probably explain the frequent involvement from the proximal interphalangeal joint. I have seen extension to the sheath from abscesses in the lum-

[1] Surgery, Gynecology and Obstetrics, September, 1905. Acute Phlegmons in the Hand. Ibid Nov. 1907 Chronic Suppurative Processes in the Hand. Zentralblatt für Chirurgie. No. 34 1907. Eitrige Infektionsprozesse der Hand und des Unterarmes.

brical canals. Here, however, the involvement is likely to be localized to the proximal end of the finger sheath. Indeed, it holds true for all of these cases which develop as a result of abscesses in contiguity. One explanation of this can be found in the fact that the contiguous inflammation has probably given rise to plastic adhesions in the sheath before the actual involvement has taken place, and again these local accumulations have generally been produced by the staphylococcus or some like germ of moderate virulence. This is also true of involvement of the ulnar or radial sheaths secondary to abscesses in the palm as was exemplified by the case of Henderson reported in an earlier contribution.

The question of lymphatic involvement is one that is not so easily demonstrable but any surgeon can recall numerous histories of patients who developed an infection of a sheath within twenty-four to thirty-six hours after a simple needle prick of a finger upon the volar or lateral surface (see Case 2). It is this type of infection that presages the most disastrous results for the patient in that localization to any part of the sheath is uncommon. These are probably generally streptococcic in origin. Whether the necrosis which rapidly ensues is due to the toxicity of the poison they generate or the great œdema and effusion into the sheath to which it gives rise with consequent pressure necrosis is a question for consideration. There can be no question, however, as to the disastrous results which follow delay in treatment. The extension from one sheath to another follows strictly on anatomical lines. Apparent exception to this is found in simultaneous involvement of the thumb and ulnar bursa without involvement of the radial bursa, the thumb being primary as was found in four of Forssell's cases. He did not note any cases of little finger infection and radial bursitis without associated ulnar bursitis. Before this is accepted as a fact further researches must be made. In two of my cases I was led to the same conclusion on first opening the sheath of the flexor longus pollicis, but further search revealed pus at both ends of the sheath.

The extension from the finger sheaths of the little finger and thumb to the ulnar and radial bursæ as well as the intercommunication of these respectively, has already been discussed. When we are dealing with an infection of little virulence such as one due to the staphylococcus we very frequently find a plastic exudate or adhesions closing the narrowed opening between these parts and the infection located in any section, as for instance, the finger sheath, ulnar bursa, radial bursa, or the intermediary sheaths at the wrist. Indeed, I have seen an infection of an ulnar bursa limited to that part of the sheath between the base of the finger and the annular ligament, the part of the sheath in the forearm being uninvolved, protected by adhesions at the annular ligament. My experience here agrees with the earlier observations of Schwartz and Gosselin and differs from that of Forssell who says that "out of 34 cases of ulnar bursitis an extension of the infection to the tendon sheath of the little finger was found in 30 cases on their entrance into the hospital and if we assume with Poirier that the ulnar bursa is completely separated in 33% of the cases, it is very improbable that a secondary boundary should in a single one of the aforementioned cases have developed through an adhesive inflammation. . . . I have never in operating upon a suppurative bursitis, found within the bursa proper, a fibrinous or plastic synovitis in such a mass as to notably affect the operation."

Besides spreading by direct continuity these infections may, of course, involve one or more sheaths secondarily by a rupture from a previously infected sheath.

I report the case of Mr. P. who had an infection of the middle finger tendon sheath which extended by way of the lumbrical canal over to the tendon sheath of the ring finger, since it demonstrates the possibility of such infection spreading to contiguous tendon sheaths, a point that has not been brought out in previous contributions.

Case 1. Mr. P. referred by Dr. A. T. Horn.

History. Patient received slight lacerated wound on the flexor surface of the middle finger. Inside of two days the finger was markedly swollen and tender and when seen in consultation on the third day tenderness was marked throughout the course of the tendon sheath, the finger was flexed and on extension presented the

greatest amount of pain at the proximal end of the sheath.

A diagnosis of tenosynovitis was made and the tendon incised throughout its length. The lumbrical spaces on either side were involved and were drained. The infection apparently subsided but on the seventh day it was noted that the ring finger was markedly flexed, tender throughout the course of the sheath and that on extension pain was present at its proximal end. The diagnosis of infection of this sheath due to contiguity of the lumbrical space was made, and the tendon sheath was incised and drained by an incision upon its flexor surface. From this time on there was an uninterrupted recovery as to the infection but the ultimate result showed the patient with moderate flexion of the ring finger at its proximal interphalangeal joint, no motion at its distal joint, and complete motion at the metacarpal phalangeal joint. The middle finger was held semi-flexed with complete flexion at the metacarpal phalangeal joint; other joints of the finger could not be moved.

The tenosynovitis of streptococcic origin most frequently has its origin in pin and needle pricks of the volar surface, especially of the distal phalanx. Why it does not occur in dorsal wounds is understood when we remember that the course of the lymphatic vessels is from the palmar to the dorsal surface. The possibility of gonococcic tenosynovitis of hæmatogenous origin must always be borne in mind in cases with an obscure origin. One such case has come under my observation.

Pathology

A classification of the changes incident to tenosynovitis may be made as follows:

Primary. *A*. Changes while the infection is limited to the sac: 1. Contents of sac, serum, tendon; 2. Wall of sac; 3. Circulation, lymphatics with œdema.

B. When rupture of the sac occurs: 1. Involvement of the fascial spaces, (*a*) hand, (*b*) forearm; 2. Involvement of the nerves; 3. Involvement of joints; 4. Involvement of bone.

Secondary. 1. Tendon adhesions; 2. Anchylosis of joints; 3. Persistent œdema and hyperplasia of cellular tissue; scar contraction subsequent atrophy; 4. Chronic osteomyelitis.

The changes occurring in the section under "Primary B." and "Secondary" have already been discussed in the two previous contributions and it would be needless repetition to consider them here in detail.

The serum in the sac in the more acute cases is normally scanty in amount and only slightly tinted. The consistency varies from a slightly slimy fluid to a thick pus. While in the more acute varieties the amount may at times be very great, it soon ruptures and on operation we may find little or much in the sac; in the more chronic type we frequently find a large amount of thick, creamy pus, even though rupture has ensued.

The wall of the sac is congested and œdematous with the exception of the part under the anterior annular ligament where the pressure is great. Here necrosis, not alone of the sheath, but also of the tendons, is prone to occur. While we may find the synovial wall clear and unchanged, we generally find it cloudy with whitish-yellow spots of beginning necrosis or we may find even early the entire wall semi-necrotic. Even in these cases we are often surprised at the reparative possibilities after drainage is instituted.

The tendons themselves are swollen, but retain their glistening synovial covering for some time. At the wrist however, the tendons show the result of compression by the non-distensible anterior annular ligament, being pale and compressed; this is accentuated by the swelling which has occurred both above and below the ligament. If the case has been left untreated for too long a time the tendons lose their glossy covering and becoming necrotic are extruded, looking like grayish strings of connective tissue.

While the entire hand partakes in the œdema, it is in the finger involved that the most extensive and persistent changes occur. Especially in the neglected cases do we see a most extensive exudation of inflammatory elements which persists for weeks after the acute process has subsided; this is followed by an atrophy of the entire finger, anchylosis of joints and impaired nerve function, which aids materially in preventing a proper use of the finger even if the tendon is not destroyed. The adhesions between the sheath and the tendon combined with these serious sequelæ make an almost hopeless prognosis as to function in the neglected cases.

Diagnosis, Symptoms, and Course

To diagnose the onset of involvement of the tendon sheaths is one of the most difficult problems in surgery; and yet withal one of the most important, since an error either way may be most disastrous. I must say, however, that more extensive experience has 'aught me that it is generally better to err by making an unnecessary incision than by failing to operate where it is needed. I know of no place where calm judgment is more required, since the symptoms and signs are all of degree.

The *three cardinal symptoms* and signs are:

1. Exquisite tenderness over the course of the sheath, limited to the sheath.
2. Flexion of the finger.
3. Exquisite pain on extending the finger, most marked at the proximal end.

These symptoms are seen to be only a difference in degree from those found in any infection of the hand, but when sought for in an intelligent manner there is not much difficulty in differentiating the conditions.

A patient applies to the physician with what is evidently a serious infection. If there has been a crushing injury the probability of an infected tendon sheath is great — on the other hand, I have seen it arise from simple cuts, as for instance, a slight laceration from a tin can or from the prick of a needle. The pain has increased in severity after a day or two. The systemic symptoms of infection may be present. The finger and the corresponding side of the hand at least are œdematous. In addition to the tumefaction in the infected finger the adjacent digits are swollen. The back of the hand particularly is œdematous. The whole hand is slightly tender to superficial palpation. The fingers are all slightly flexed. Now, how shall the differential diagnosis be made? Press deeply and firmly in all parts of the hand and fingers; the patient will volunteer the information that they all hurt, but if the tendon sheath is involved *pressure upon it throughout its course causes an immediate and involuntary expression of pain*, and while before the patient has allowed his hand to remain passive in yours, he will now attempt to withdraw it involuntarily, and there is no doubt in your mind of the exquisite tenderness at this point. If this tenderness is outlined by the extent of the sheath, your diagnosis is nearly made. As a matter of fact the greatest tenderness is generally complained of on deep pressure at the proximal end of the finger sheaths in the palm of the hand, just over the metacarpophalangeal articulation. I have seen a lacerated wound on the back of the finger which was inflamed and naturally tender show much less sensitiveness than the infected sheath on the opposite side of the finger where there was no injury. Now, make *passive extension of the finger* and the patient immediately complains of severe pain along the tendon sheath, very often again most marked at the site of the metacarpophalangeal articulation. This is a valuable symptom. The *flexion of the fingers* is of less importance and is probably due to several factors; the arthritis in the finger joints, possibly irritation of the adjacent filaments of the median or ulnar nerve, and again possibly because it lessens the tension upon the tendon. The finger is generally held rigid in that position and a difference is readily seen between the simple flexion occurring in the adjacent swollen fingers and the rigid flexion of the infected finger. So marked is this that often one is able to diagnosticate an extension into the palmar sheath, for instance, from the little finger sheath since the *character of the flexion changes* in that case at once in the fingers supplied by these tendons which pass through this common sheath. Mauclaire has described a claw-hand position but I have not found it to be characteristic.

There are two clinical types to be differentiated. First, that variety in which the infection is a local one, generally of staphylococcic origin, commonly following lacerated wounds. Here we have a local infection beginning slowly; plastic adhesions may be present limiting the infection to a particular part. There is little general reaction, but the local evidences of inflammation are marked. A second type is that in which the injury is generally a slight one, a pin prick or an insignificant cut. It is generally of streptococcic origin. The infection is carried to the sheath by lymphatics. The pain is severe and within a few hours the finger is greatly swollen, red and exquisitely tender. The evidences of

toxæmia are present early, but the red lines running up the arm indicative of a lymphangitis are absent. This type not having a tendency to plastic adhesions spreads rapidly throughout the entire communicating system of sheaths. This is distended with a fluid, at first only cloudy but rapidly becoming purulent and on examination we find thick pus with fragmented nuclei, due probably to the virulent toxines, and here and there streptococci. This type is prone to produce early rupture and extension into the connective tissue spaces.

The spontaneous pain which was at first severe grows less as the œdema develops and may delude the surgeon into believing that the process is subsiding. The arm seems "to fall asleep" as the patient expresses it. Paræsthesias, with creeping and itching sensations, may be present, and especially after rupture of the sheath the tenderness may subside to a considerable degree leading the surgeon to an early erroneous conclusion.

INFECTIONS BEGINNING IN THE LITTLE FINGER

An infection of the sheath of the tendon in the little finger may be localized to the finger. Extensions to other areas are possible however (Fig. 11). The following are the most common: 1, The ulnar bursa; 2, the radial bursa; 3, the forearm; 4, fascial spaces in the hand, *a*, middle palmar space, *b*, lumbrical space; 5, osseous involvement, middle phalanx; 6, joints, proximal interphalangeal, wrist; 7, rupture to the surface.

Extension to the ulnar bursa. In the fulminating type where the opening between the ulnar bursa and the sheath in the little finger is present, it extends rapidly throughout the hand. It should be noted here that the frequency of extension from the one to the other is greater than the anatomical opening would explain; we are therefore led to conclude that the opening is present much more frequently than is stated or there is some other method of extension, possibly by the lymphatics.

This extension is often difficult to diagnose. It is marked by the development of œdema in the hand especially upon the dorsum. A general fulness in the palm is found, but the palmar concavity is still present. On the flexor surface the greatest swelling is just proximal to the annular ligament. This is not necessarily due to the rupture of the sheath here but to the looseness of the tissues which permits of distention. This swelling is accentuated by the non-distensible annular ligament distal to it. The swelling in the palm occurs at the same time but is not so conspicuous owing to the palmar fascia. This also diffuses the swelling so that it is not accurately limited by the outline of the ulnar bursa. Moreover the surrounding œdema tends to confuse the picture. In relation to this, Forssell states:

"One very seldom finds in acute infections of the bursæ so great a collection of pus within the latter as to cause a purely mechanical swelling of such extent that one can easily see it from the outside. The wall of the bursa, before an extensive formation of exudate, is necrotic and has usually permitted the accumulation to escape into the surrounding connective tissue spaces."

As to fluctuation, Mauclaire says: "Fluctuation is almost the rule. One can easily notice it by placing the fingers above and below the annular ligament." While I agree that a sense of fluctuation can be noted by this manœuver, yet the œdema and swelling is of such a character that I cannot attach the significance to it that is given by Mauclaire. One should never wait for this symptom before operating. In chronic tenosynovitis, such as tuberculous infection, the symptom is of undoubted value.

The most conspicuous and valuable sign is the extension of the exquisite tenderness to the area involved. It should be remembered that this is absent after a few days. The wrist becomes fixed, the thumb shows tenderness to pressure, and particularly on passive movements is the sensitiveness noted. It is seen readily of how much importance this latter symptom is in diagnosing an extension to the ulnar bursa from the little finger. We note that while at first the symptoms are limited to the little finger and slight changes in the ring finger because of its juxtaposition, all at once the thumb begins to show the characteristic signs while the index and middle

fingers remain unchanged except for the increase of pain on passive extension explained above. This sensitiveness of the thumb may be due to either the juxtaposition of the sacs or to a real extension into its sheath.

At first there may be a diffuse redness of the palm and dorsum, but it rapidly gives place to a whitish or even cyanotic hue. Above the wrist however, the tissue generally takes on a marked red color which later becomes violaceous. The temperature and pulse may not be of any diagnostic importance. Ordinarily after the infection has lasted a few days and the walling-off process has begun, the temperature is that of the local accumulation of pus and varies with the freedom of drainage. In the first few days however, the systemic absorption bears no relation to the abscess formation and cannot be relied upon for diagnostic purposes.

Extension to the radial bursa is diagnosticated as following an ulnar busitis by the increased swelling and tenderness in the thenar eminence and along the sheath. The tumefaction of the thenar area is not that of abscess in the thenar space. Forssell states that this extension occurred in 6 out of 29 cases coming under his observation, average age 50–58 years; 23 cases remained confined to the ulnar bursa, average age 36–39 years.

Extension to the forearm. By this we mean a rupture from the proximal end of the sheath and an extension along the connective tissue spaces or rather the intermuscular spaces. As I have already pointed out the pus passes between the pronator quadratus and the flexor profundus to the area between the latter and the interosseous membrane and at about the middle of the area it passes more superficially and to the ulnar side along the ulnar artery and nerve. Since my earlier contribution demonstrating the area of this extension I have had opportunity to verify it several times in cases I have operated upon, and have also seen it in one fatal case I had an opportunity to dissect (Case 3). This extension is characterized by a brawny induration that should not be confused with the softness of an œdema. No fluctuation should be expected since the accumulation lies too deeply. This extension is marked also by the loss of the relative swelling immediately above the annular ligament due to the distended upper end of the sheath. This swelling is not any less but that of the arm is greater. The tenderness may become less, so cannot be depended upon as a symptom. The redness is generally greater and spontaneous pain while at first marked rapidly subsides. At this time some pus may accumulate subcutaneously above the wrist and lead to the supposition that there is no pus under the tendons, so that valuable time is lost.

Extension to the lumbrical and palmar spaces. One of the commonest sites of extension is into the lumbrical and palmar spaces. The involvement of the adjacent lumbrical space occurs so frequently as to keep us continually on our guard since involvement of the tendon of the adjacent finger or palm occurs very easily from this. It is characterized by tenderness, swelling, and pain at the site. The tissue between the fingers on the dorsum of the corresponding web is generally swollen and red; the side of the finger adjacent to the infected finger is often red and tender. It begins to swell slightly and by extension the tendon sheath of that finger often becomes involved with the characteristic symptoms and signs. In involvement of the lumbrical space alone, the swelling of the area involved is marked. The middle palmar space is most commonly involved either by extension along the lumbrical space or from rupture of the ulnar bursa which lies in juxtaposition. The thenar space is never primarily involved in little finger infections. Involvement of the middle palmar space is characterized by a slight bulging of the palm replacing the normal concavity. The symptoms and signs of this complication, as well as those observed in osseous and joint involvement have been discussed in my earlier contributions.[1] Also mention has been made of the frequency of rupture of the sheath through the palm to the surface at the proximal end of the finger sheath.

[1] In my first contribution I reported in detail experiments demonstrating the sites of extension from the sheaths. One experiment was quoted for each common extension, it being my intention to report the experiments in full in relation to tenosynovitis. On second thought, however, I feel that it would be an unnecessary use of space and I will simply refer the student to that section. The typical results there detailed represent the usual sites of extension as determined by over sixty experiments. Since that time I have had opportunities so often to verify the truth of the deductions that I shall not burden this contribution with the detailed report.

INFECTIONS BEGINNING IN THE INDEX, MIDDLE, AND RING FINGERS

Involvements of the index, middle, and ring fingers present the same signs as the little finger. The only difference is that here the paths of extension are different. Besides the extension to the surface at the proximal end, involvement of the middle phalanx, and the proximal interphalangeal joint, the finger may show extension to the lumbrical space on either side, and from here the adjacent tendon may be involved (see Case 1). The fingers differ somewhat in the method of their extension into the palm as will be seen by noting the accompanying drawings (Fig. 12, 13, 14). As illustrating this extension from the index finger into the thenar space with no involvement of the palm, I record the case of Miss M., seen with Dr. Besley at the Post-Graduate Hospital. The probability of this extension was pointed out by myself experimentally some time before I had an opportunity to observe a clinical case proving the assumption. Fig. 15 shows such a condition.

Case 2. Miss M. seen in consultation with Dr. F. A. Besley at the Post-Graduate Hospital, October, 1906.

History. Patient stated that twenty-four hours before she ran a needle in the distal phalanx of the index finger of her right hand. Inside of seven or eight hours the pain became severe and she arrived at the hospital complaining of excessive pain and tenderness.

Examination. Patient's temperature 102.5; pulse 100. Index finger seemed to be swollen slightly. Tenderness was present over the entire finger and the lower portion of the hand on the radial side without localization at any point. The glands in the axilla swollen, those in the elbow not involved. No lymphatic lines seen.

Treatment. A diagnosis of lymphatic infection, possibly tenosynovitis, was made and hot boric dressings applied.

The next morning the temperature had fallen markedly and the patient insisted on leaving the hospital. She returned in two days with all the evidences of acute systemic infection, temperature 102°, headache and sleeplessness. Locally the finger presented about the same appearance as when seen two days before, except that there was a slight increase in swelling and the thenar space from the adduction crease in the thumb seemed to be ballooned out from the remainder of the hand. The concavity of the palm was still present.

Diagnosis of previous tenosynovitis in the index tendon sheath with rupture at its proximal end and involvement of the thenar space was made.

On operation, pus was found to be present; there was a very large accumulation in the thenar space which was drained by through and through drainage from the palm to the dorsum between the metacarpal bones of the index finger and the thumb. Tendon sheath of index finger opened throughout its extent.

Course. Patient's temperature rapidly subsided and in two or three days was normal or 99°. Infection of the thenar space had entirely subsided at the end of seven days and the wounds healed promptly. The opening in the tendon sheath of the index finger however, was present for four weeks, necessitating repeated dressings.

Result. Recovery with all functions except flexion of the distal phalanges of the index finger.

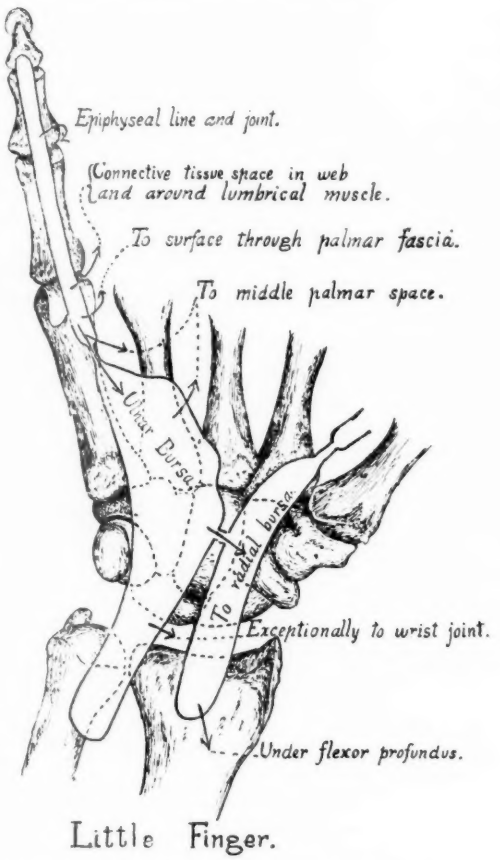

Epiphyseal line and joint.
Connective tissue space in web and around lumbrical muscle.
To surface through palmar fascia.
To middle palmar space.
Ulnar Bursa.
To radial bursa.
Exceptionally to wrist joint.
Under flexor profundus.
Little Finger.

Fig. 11. Schematic drawing showing the various probable extensions from an infection of the tendon sheath of the little finger.

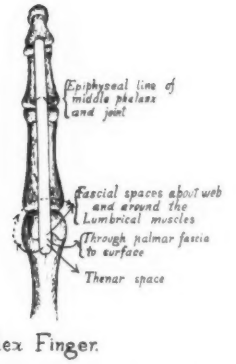

Epiphyseal line of middle phalanx and joint
Fascial spaces about web and around the Lumbrical muscles
Through palmar fascia to surface
Thenar space
Index Finger.

Fig. 12. Schematic drawing showing probable extensions from an infection of the tendon sheath of the index finger.

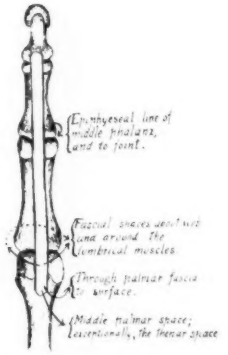

Epiphyseal line of middle phalanx, and to joint.
Fascial spaces about web and around the Lumbrical muscles
Through palmar fascia to surface.
Middle palmar space; occasionally, the thenar space
Middle Finger.

Fig. 14. Schematic drawing showing probable extensions from infection of the tendon sheath of the middle finger.

INFECTION BEGINNING IN THE RADIAL BURSA

The gravity of tenosynovitis of the flexor longus pollicis of the thumb has long been recognized. The symptoms and signs common to the other fingers are found here. To diagnose the extension into the radial bursa and then to the ulnar bursa is more difficult. Let us suppose the thumb has been the seat of the primary infection. This member is very painful, the index finger slightly sensitive, and the other three fingers hardly at all. After a time if it spreads throughout the sheath all the fingers become more painful to passive extension, and should the infection pass over into the ulnar sheath all the fingers become flexed and pain severe upon extension of the tendons, most marked however in the little finger. In other words, it assumes the character of an ulnar sheath infection. The tenderness over the sheath is not always so marked in secondary involvement however, due possibly to the previously developed œdema. I recall one case where the only marked tenderness was at the base of the little finger. Here, however, owing to this tenderness which was not present at the base of the other fingers, a diagnosis of involvement of the ulnar bursa was correctly made. Forssell's statistics show that twenty-three out of twenty-seven cases of radial bursitis extended to the ulnar bursa, average age 43 years; the four that remained confined to the radial bursa averaged 37.5 years in age.

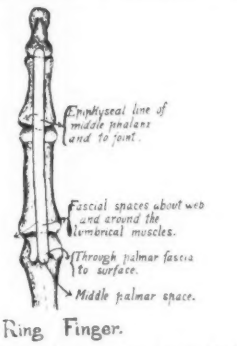

Epiphyseal line of middle phalanx and to joint.
Fascial spaces about web and around the lumbrical muscles.
Through palmar fascia to surface.
Middle palmar space.
Ring Finger.

Fig. 13. Schematic draiwng howing probable extensions from the infection of the tendon sheath of the ring finger.

One fact may confuse the surgeon in that the tenderness over the radial bursa may be absent. Not only that, but upon operation no macroscopic pus may be found in the middle part of the sheath. By careful extension of the incision and pressure upon the two ends pus may be brought into the wound. I cannot emphasize too strongly that in the early stage of secondary involvement of the ulnar bursa, there is not marked swelling upon the palmar surface and that there is no especial tumefaction over the ulnar bursa (Fig. 16).

The extension to the radial bursa is generally accompanied by a swelling above the anterior annular ligament, just as in ulnar bursa infection. It may rupture into the tissues of the forearm and then the pus lies under the flexor profundus tendons as previously described in discussing rupture of the ulnar bursa.

Fig 15. Photograph showing the ballooning of the thenar space when filled with pus. Note that the concavity of the palm still remains.

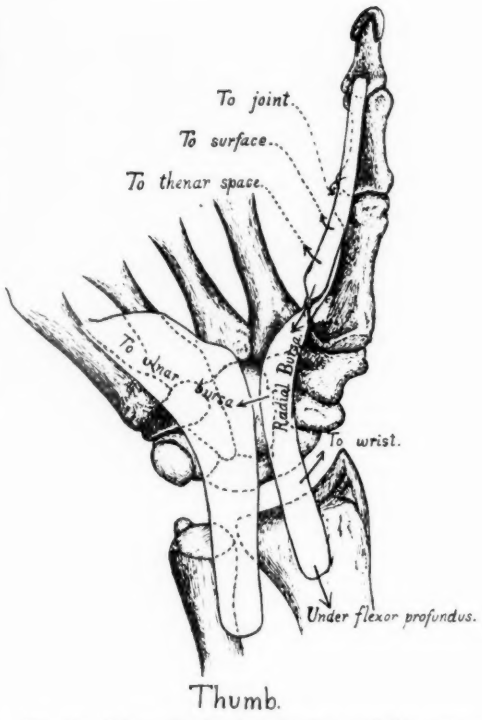


Fig. 16. Schematic drawing showing probable extensions from infection of the tendon sheath of the thumb. (Flexor longus pollicis).

DIFFERENTIAL DIAGNOSIS

One may mistake a lymphatic infection for a tenosynovitis. Here, however, the red lines of lymphatic involvement running up the arm without the localized tenderness over the tendon sheaths, the slight pain on moving the fingers, the generalized œdema of hand and arm in contradistinction to the localized swelling found in the early stage of tenosynovitis aid us in the diagnosis. Again, we may be in doubt as to whether we are dealing with a tenosynovitis of the ulnar or radial bursa or a rheumatism of the wrist. I have seen several such cases and in one case it was difficult to determine whether the patient was suffering from a gonorrhœal rheumatism of the proximal interphalangeal joint of a finger or a gonorrhœal tenosynovitis with secondary involvement of that joint. The latter assumption was later found to be the condition present. In those cases where there is a lack of traumatic history and the apparently spontaneous development of an inflammation, especially at the wrist, the diagnosis may be most difficult in spite of the ease with which a theoretical differential diagnosis is made. Here again however, the localized tenderness over the sheath and pain on extension of the finger are of the greatest importance; moreover, these cases are always virulent and extend rapidly, so that if it be a tenosynovitis the hand grows rapidly worse. In a rheumatism there is as much pain on the dorsal as on the volar surface; the swelling involves the wrist more than the hand, fingers, or forearm; and other joints may be involved. The presence of a gonorrhœa does not aid us materially since either condition may follow. Subcutaneous infections are seldom difficult to differentiate. Localized infections of the middle palmar and thenar spaces, particularly the former, generally do not give rise to much confusion unless they develop from a previously infected sheath. When independent, if the middle palmar space is involved, they generally arise from infections between the fingers. The course and condition is easily determined, owing to the localization of the swelling and pain in the respective areas.

(*To be continued in the February number*)

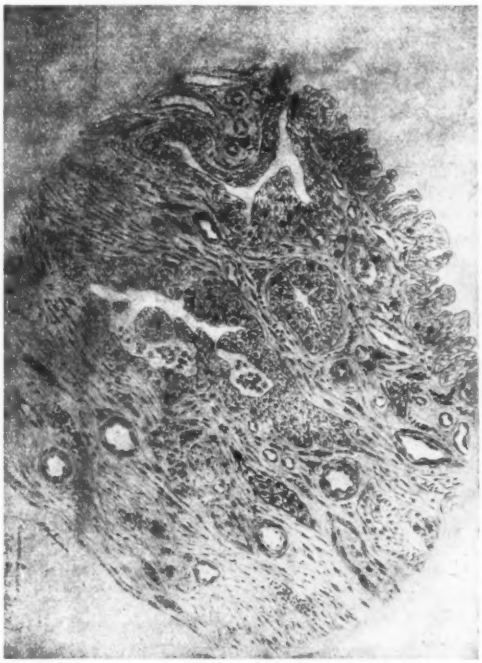
REPORT OF TWO CASES OF CARCINOMA OF THE GALL-BLADDER WITH REMARKS ON THE PRESENCE OF STONES AS A FACTOR IN THE ETIOLOGY

By R. R. HUGGINS and W. H. INGRAM, Pittsburg, Pennsylvania

MANY investigators, while giving us an increased knowledge concerning the histological structure of carcinoma have still left its etiology an unsettled question. We are unable to treat any disease successfully unless familiar with its cause.

So far, owing to our ignorance concerning its etiology, the treatment of malignant disease has been largely experimental. We have learned to look with suspicion upon one factor in the production of the malignant change in tissues, and that is irritation. This is evident, because it generally develops in tissues subjected to continuous irritation. For this reason the surgeon now advises the removal of pathological conditions in certain organs where he fears they may act as irritants to the tissues, and thus eventually bring about epithelial proliferation. Chronic gastric ulcer may form the starting-point of cancer, and it has been well said that the time to operate to cure gastric carcinoma is while the disease is still in the stage of chronic malignant ulceration. There seems no longer any doubt in the minds of most pathologists that gastric cancer is frequently developed from a preceding ulceration with chronic irritation of the ulcerating surface. Warts and moles are now removed because when subjected to long-continued irritation they break down and malignancy develops. Growths which were frequently regarded as simple and benign are now looked upon as possible sources of future danger.

It is difficult to explain the intimate connection which exists between prolonged irritation and the development of carcinoma and we are yet unable to calculate the distance from chronic inflammatory hyperplasia to malignant change. The above being true, there can be no doubt that stones in the gall-bladder play an important part in the causation of carcinoma of that organ. The irritation can be produced by rough calculi or by recurring attacks of cholecystitis.



Microscopic section from Case 1.

Gall-stones are found present in primary cancer of the gall-bladder in a large percentage of cases. Courvoisier, in reviewing literature, found stones present in 74 in 84 cases; Siegert, 94 in 97; Zenker, 41 in 48; Bodowski, 40 in 40. Many others report a like proportion Schroeder says, "No less than 15 per cent o. patients with gall-bladder disease eventually succumb to cancer." Slade, in an interesting article upon gall-stones and cancer, makes the following statements: "In 2,180 consecutive complete necropsies there were 33 cases in which gall-stones were found either in the gall-bladder at the post-mortem examination or had been removed by operation at a short interval before the patient's death. In 17

of the 33 cases the gall-stones were latent and were discovered only at the necropsy. In the remaining 16 cases gall-stones and complications caused thereby were responsible for the patient's death.

Carcinoma of the gall-bladder was found (1) in 30 per cent (10 in 33) of all cases of gall-stones; (2) in 56 per cent (9 in 16) of all cases where gall-stones had caused symptoms during life; and (3) 58.8 per cent (10 in 17) of cases in which at the necropsy the wall of the gall-bladder showed inflammatory thickening. In twelve cases the wall of the gall-bladder presented an appearance which at the time of the necropsy was described as "chronic inflammatory thickening." In seven of these cases, unfortunately, no microscopical examination was made, but in every one of the remaining five cases subsequent histological investigation showed the presence of carcinoma."

It should be noted particularly that in this calculation seven of these cases were not submitted to microscopical examination and have all been reckoned as non-cancerous, although to the naked eye they presented an appearance exactly similar to that of the five cases which were examined and proved to be carcinomatous. Since I began in all such cases to examine the wall of the gall-bladder, as a matter of routine, I have in no instance failed to find indubitable carcinoma; hence, I do not hesitate to suggest that had all the cases been examined the percentage showing carcinomatous change would have been much nearer 100 than 58.

In commenting upon the casual relation between gall-stones and carcinoma the author says, "The present series of cases lends strong support to the view that the gall-stones are the cause, carcinoma the effect; if regard be paid to the following considerations: 1. In two cases symptoms attributable to the presence of gall-stones were of long duration; 2. In five other cases considerable fibrous thickening of the wall of the gall-bladder, in itself evidence of long continued irritation, was associated with a very early stage of carcinoma; 3. In reference to the other cases it is to be noted that while prolonged symptoms are valuable evidences, brief duration, or absence of symptoms is of little importance, for it is notorious that gall-stones may be absolutely latent throughout.

It is unnecessary to dwell further upon statistics offered by many reliable authorities. Two patients have been recently operated upon by the writer for disease of the gall-bladder, where previous to operation diagnosis was made of carcinoma as a result of prolonged irritation due to the presence of gall-stones.

The history of the first patient (case 1) is interesting for the reason that she never presented marked symptoms of gall-stones. For many years previous to the onset of present trouble she had been subject to "bilious attacks."

An interesting feature in the study of the pathological specimen is the development of malignancy in the presence of such well-marked chronic inflammatory changes. The history and result suggest the necessity for more careful investigation and a proper diagnosis in patients presenting above symptoms, namely, bilious attacks, recurring regularly throughout a number of years.

CASE 1. Mrs. L. Referred by Dr. W. N. Marshall. Age 51. Occupation, home duties. Father died at 70 from apoplexy; mother at 52 from "enlargement of liver;" brother at 45 from typhoid. No history of tuberculosis in the family. Two sisters of father died of cancer, one of the stomach, the other of the uterus; three sisters and two brothers living and well.

Past History. Had diseases common to childhood. Married at 18; had eight children (four boys, four girls), two dead, girl of typhoid, boy of railroad accident. Menopause at 40 with little distress. Malaria twenty years ago. For past six years has noticed a rapidly appearing jaundice, which would continue for a period of several weeks, coming regularly every spring and fall, and ending with a bad "bilious attack." During that time she vomited large quantities of bile. After the attacks, eructations of gas, pyrosis, epigastric distress, and irregular bowel action, passed away and the patient would feel well again. Stools at these periods showed some absence of bile, but not marked. Urine was more scant and very highly colored.

Present Illness began about two weeks before admission with severe pain radiating to right shoulder from region of liver and gall-bladder. Had noticed that her stomach had been worse a few weeks prior to onset.

Examination. General appearance very good; large woman, usual weight 165 (noticed a loss of flesh for some time). Mucous membranes healthy, but some anæmia. Eyes, normal except for yellowish discolora-

tion of sclera. Tongue slightly coated, breath slightly fœtid, with a bad taste in the mouth. Respiration slow and full. Heart good. Pulse slow, of fair volume. Arteries somewhat hardened. Abdomen rather large, soft, no points of tenderness except in right hypochondrium, where pressure under costal margin elicits pain. Liver somewhat enlarged. A slight enlargement below lower border of liver can be felt. Spleen normal. Kidneys not palpable. Peristalsis good. Bowels constipated; stools clay colored. Urine, small daily amount, of low sp. gr-1004, acid, negative for albumen, sugar, and blood, some bile, color dark, with dark ppt. of mucus and calcium oxylate. Blood, hæmoglobin 76 per cent; r. b. c, 4,500,000; w. b. c, 8000.

Operation: 6-24-'08. Cholecystectomy. Incision at edge of right rectus; abdominal wall very thick. Peritoneal cavity opened, when a large, distended gall-bladder appeared. It was surrounded by many adhesions. The wall of the gall-bladder was very thick, with places showing areas of degeneration and necrosis as large as a dime. Entire gall-bladder with considerable underlying liver tissue removed. Wound closed without drainage.

Gross Appearance of Specimen. Walls of gall-bladder vary from one-fourth to one-half inch in thickness. When opened, cuts like cancer tissue. The appearance of the cut tissue is that of chronic inflammatory change. Contains three large gall-stones facated side by side and filling the gall-bladder.

Pathological Report by Dr. Ingram. Surface of mucosa very irregular, thrown up into papillomatous elevations and folds with many secondary projections. The surface epithelium varies, in many cases being limited to single columnar, but generally showing a marked proliferation into two too many layers, with a tendency to pseudo-stratified columnar epithelium. In various places in the field, may be noted gland-like depressions lined with the type of epithelium above mentioned, projecting to the lower part or the limits of the muscularis. In none of these sections is the fibrosa penetrated. These gland-like structures vary in size, branching repeatedly and lined by epithelium varying from three to ten cells thick.

In the muscularis they show the most marked tendency to epithelial proliferations where the lumen in general is obliterated, and the plug or column of epithelium becomes characteristic. In many areas the muscle cells are more or less deficient, but as a rule the zone can be easily recognized. In character, the individual epithelial cells of the gland-like areas vary from columnar to laminated near the surface of the mucosa, to typical carcinomatous epithelium in the deeper parts. Degenerated cells are not abundant, the nuclei staining rather uniformly.

In some parts evidences of necrosis and nuclear fragmentation may be seen. In the deeper parts of the tunica propria of the mucosa and in the inner part of the fibrosa the penetration of the epithelium into the lymph spaces is characteristic, tending to take the adenomatous type, later the solid columns. All the tunica of the viscus shows marked hyperplasia. The tunica propria of the mucosa is markedly fibrous. The interstitial connective tissue of the muscularis is increased, replacing the muscle cells until it occupies relatively two-thirds of the space taken by the muscle cells.

The muscle cells are large and plump with here and there evidences of necrosis. The relation of layers of muscle cells has been destroyed by the penetration of the epithelial structures and by the fibrosa. The muscularis mucosa has been obliterated. The fibrosa is greatly thickened, — densely fibrous, with an unaltered serous covering.

The vascular structures are not involved in an unusual manner, many arteries and veins being found in the appropriate tissues, with large capillaries in the mucosa. No evidence of hæmorrhage. In all the tunics, in addition to the interstitial hyperplasia, may be noted areas of round cells and leukocytes, generally the former. These are particularly marked in the three inner coats, but may also be present in the fibrosa. The round-cell areas vary from a single row of cells in a lymph space to areas one-half the thickness of the tunic involved. As a rule these cells are characteristic round cells of inflammation. Many isolated round cells may be seen in all the tunics, in addition to the areas noted. Comparatively few plasma cells present.

In some parts of the sections the proliferation of the fixed connective-tissue cells may be marked, but as a rule the tendency to the fibrous type of connective tissue mentioned is characteristic.

Leukocyte infiltration into the epithelium of the surface of the organ, as well as in the same structures of the tumor, is marked. In some of the adenomatous masses large numbers of leukocytes may be seen, almost filling the lumen. No hæmorrhages are found with this lumen infiltration.

Pathological Diagnosis. Adenocarcinoma plus chronic fibrosis (inflammation) of the gall-bladder.

DISCUSSION

In this specimen sections show marked connective-tissue hyperplasia involving all the tissues. The thickness of the tissues is markedly increased. The new tissue is distinctly of the fibrous type, the fiber bundles being well formed, with long spindle-shaped fibroblasts relatively normal in position. Intervening between the bundles newer islaoted connective-tissue cells are regularly distributed. Scattered through all the tunics, in some sections more abundant in one, while in others more evenly disposed, are the areas of round-cell infiltration noted. To these may be added smaller, and relatively less frequent, leukocyte areas. That these round-cell areas are not all the usual accompanying areas found in carcinomata is evident, when the positions and numbers are considered.

Probably the most marked alteration produced by this hyperplasia is in the muscularis. Here the muscle cells are almost uniformly separated by distinct connective-tissue bundles. This area also shows the penetration of the epithelial structures in a characteristic manner. In addition, the muscularis mucosæ, as well as the lymphoid structures in the mucosa, have been completely replaced by the hyperplasia and the penetrating epithelial masses. In the fibroserous layer the connective-tissue increase is even more marked, the fiber tissues being generally parallel with the surface, interlacing, and forming a dense capsule-like structure with no alteration in the endothelium of the surface.

From the appearance of the surface of the organ, its altered epithelium and irregular papillomatous outline, and the marked columnar invasion of the gland-like structures forming the carcinoma, a strong suggestion is offered that the carcinoma is secondary. This view may be strengthened by the character of the carcinoma, distinctly adenomatous in the mucosa and the submucosa, while in the muscularis and the serosa much smaller masses, as well as of distinctly glandular type, — the type penetrating into the lymph spaces as marking secondary carcinoma transformation. In all characters the fibrosis seems to be primary and in excess, and the epithelial masses smaller in amount and secondary. In this case it appears from the study of sections as if irritation was the primal factor, — that the carcinoma developed secondarily.

The relation of "cure" of this type of carcinoma involvement, after removal, is also suggestive. In this specimen there was a marked alteration in all the tunics, but particularly in the outer. It here is dense, fibrous, and capsule-like, with an unaltered endothelial surface. The carcinoma has been apparently limited in its infiltration by it.

There is no doubt now that carcinoma removed before infiltration into other areas, or secondary involvement, does not recur. As long as a capsule-like structure is present this infiltration is inhibited. This seems to involve a conservative process, and no doubt, as much as can be deduced, removal should be followed by cure.

BRIEF REPORT

CASE 2. Mrs. R. Referred by Dr. Clark. Aged 48. Family history gives no malignant disease. Three children.

Past History. Usual diseases of childhood. Menstruated first at the age of 15. Pelvic organs have always functionated normally.

General Health. Always good until five years ago, when she had an attack of typhoid fever. Since this illness patient states that attacks of abdominal pain have been frequent. Pain seemed to be most severe in the region of the stomach and left side, at times was located in the right side in the region of the gall-bladder. Stomach was irritable and vomiting frequent during attacks of pain. Considerable annoyance from distention of stomach by gas after eating. Bowels constipated. No jaundice until beginning of present illness.

For two months previous to admission the pain has been more constant and severe. Loss of strength and weight has been considerable.

Examination. Medium size. Weight 120. Anæmic in appearance, and a yellow tinge in the color of skin is quite noticeable. Abdominal walls thin; palpation of abdominal organs quite easy. There is a downward displacement of all the intraabdominal organs. Pelvic organs normal except a retroversion of the uterus. An enlargement in the region of the gall-bladder is easily palpated, which is about the size of a small lemon. It is tender to the touch and moves upward and downward with excursions of the diaphragm. Urine contains bile; otherwise normal.

Diagnosis was made of carcinoma of the gall-bladder in the presence of gall-stones.

Operation. Incision through the right rectus. Adhesions about the gall-bladder and colon very numerous. The walls of the gall-bladder thickened and hard. A number of nodular growths extending deeply into the liver have their start from the region of the gall-bladder. Gall-bladder and as much of the surrounding liver structure as was possible were removed. The walls of the gall-bladder thickened and hard, closely surrounded and adhered to a large stone about the shape and size of a hen-egg. Patient recovered from operation but died four months later from general involvement of the liver by the malignant-process.

The Report of the Pathologist was, adenocarcinoma of the gall-bladder. The history sustains the theory that the gall-stone was the result of an attack of cholecystitis either during or following the typhoid.

TEMPORARY COLOSTOMY AS A CURATIVE MEASURE IN CERTAIN FORMS OF POST-OPERATIVE FÆCAL FISTULÆ[1]

By JOHN M. ELDER, M. D.
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POST-operative fæcal fistula, as an unfortunate and undesirable sequel to pelvic operations where dense adhesions require to be dealt with by the operator, is not rare. In most pelvic cases the leak from the intestine is connected with some part of the large bowel (colon or rectum). As a rule these fistulæ — one end of which is at the bowel and the other at the abdominal wound, or in the vagina — will in time granulate up, and thus cure themselves. But a certain number of them persist, due in some instances to their anatomical relations, in others to the lowered vitality of the patients, as a result of concurrent disease, as well as of the invalidism necessitated by the fistula itself, to say nothing of the mental and physical suffering such a nasty condition entails. And thus a "vicious circle" results, and these patients are the bane of the attending surgeon or gynecologist.

To dissect out these fistulæ and close the bowel opening, is often a most difficult operation, and statistics show that it is accompanied by a high mortality. Bryant places the death rate after such operations at 28 per cent, Tillman at 27 per cent.[2] Often, too, the physical condition of such patients precludes such operation and yet they cannot leave hospital as they are. It was while discussing one of these cases a few years ago with my colleague, Dr. Lockhart, gynecologist to the Montreal General Hospital, that we thought of trying the plan outlined in this article. The proceeding is only applicable to fæcal fistulæ of the colon or rectum.

Roughly speaking, this plan was to "short circuit" the fistula by opening the colon above the bowel end of the fistula (colostomy), and through this artificial anus all the contents of the bowel would pass until such time as the then undisturbed tract of the fistula should heal, when the colostomy wound would be closed and the fæcal flow again be directed into the normal channel. During the time intervening between the establishment of the colostomy and its subsequent closure, these patients left the hospital, wearing a colostomy cup and belt, and by proper climatic and dietetic treatment they regained good health and were often able, in the interim, to attend to their ordinary duties.

All this may seem simple enough, but it meant that before doing the colostomy we had to have several questions answered, and to get reliable replies involved considerable clinical labor and ingenuity. First of all, we had to determine, if possible, where the bowel end of the fistula was. This we did, in most cases, by the use of the electric proctoscope, assisted by injecting through the fistula a solution of methylene blue. We could thus see the blue fluid flowing into the bowel. In one case (a fistula from a median abdominal incision) we could not see the bowel opening through the proctoscope, and the position of this fistula was mapped out by filling it with liquid plumbage and then taking a skiagram, which showed that the fistula ran upward out to the left and was evidently at or about the sigmoid region. Here, of course, we had to do a right-sided colostomy in order to effect a cure (case 3 infra).

A foreword as to the operation itself. Colostomy was done in two stages, after Madyll's method, but with this important variation, namely, that the opening through the abdominal parietes was made after the manner recommended by McBurney in his "gridiron," or intermuscular incision for removal of the vermiform appendix. Bringing the colon up through these separated muscles gave, in most cases, good sphincteric control of the artificial anus, and defæcation thus became

[2] Annals of Surgery, June, 1907, p. 827.

[1] An abstract of this article was presented by the author at the Ottawa meeting of the Canadian Medical Association, 1908.

largely a *voluntary* act on the part of the patient, with consequent gain in comfort and cleanliness.

As regards the treatment of the old fistulous tract, it received practically none beyond irrigating through into the bowels once or twice after we had established colostomy. "The part was put at rest and it healed" (Hilton). These patients all went home after the colostomy operation and remained there for periods varying from three to seven months (v. infra), suffering practically no inconvenience. The fistulæ closed usually within a month after colostomy was established. My instructions were that they should not return for closure of the colostomy until at least six weeks after closure of the old fistula. By this method four cases have now been operated upon and the results have been so uniformly good that I felt I should record them. The operation is practically without risk, is not difficult in any way to do, and secures for these patients what they so much need — a change from the hospital to their own homes, and a chance to recuperate. The increased personal comfort of the patients, even with the colostomy, was most marked, and the moral effect of being able to be "up and about" is not to be lightly valued in estimating the causes which make for a cure.

Case 1. Marie G., aged 17, unmarried, entered the gynecological ward of the hospital in December, 1905, complaining of pelvic pain and irregular menstruation for a year. A diagnosis of chronic pyosalpingitis was made, for which an operation was undertaken. Very dense adhesions were found and several days after operation a rectovaginal fistula developed. She was very anæmic and emaciated, and there was a marked tubercular family history. In March, 1906, she was sent to her home in the country for a time, in the hope that she might recuperate sufficiently to justify an operation for closure of the fistula. Two months later she returned unimproved, and complaining very much of the pain and discomfort of the fistula. Dr. Lockhart felt that in her then condition of health it would be useless to attempt operative repair of the fistula, and I saw her in consultation with him, and the plan I have outlined at the beginning of this article was then agreed upon. On May 18th I did a left inguinal colostomy, and on June 1st the patient returned home with instructions to rest as much as possible in the open air, and to return for closure of the colostomy wound two months after the fistula had ceased to discharge. She reported that there was no discharge after she had been one month at home, and that her health and weight had improved in a most marked degree. The artificial anus had given her very little trouble and she had good sphincteric control of the bowels. On September 24, 1906, we closed the colostomy opening as the old fistula was found perfectly healed. The closure was accomplished by excising the skin around the opening, freeing the bowel, and clearly defining all the layers of the muscles in the abdominal walls. The opening in the colon was closed after excising the edges, with a running suture of fine catgut, reinforced with a Czernay-Lembert suture of fine silk, after which the bowel was dropped back into the opening and the peritoneum closed over it. The muscles were then closed layer by layer, as in an interval appendix operation, except (if it be an exception) that a cigarette drain was passed down to the peritoneum and left there for twelve hours. The patient was put upon liquid diet and a little morphia given for the first twenty-four hours, and after that Pil. Opii gr. i., t.i.d. for four days. On the fifth day after operation a dose of Ol. Ricini was given, followed by a small s.s. enema and the bowels moved well. Recovery was quite uneventful and the patient returned home on the 15th day after the operation and remains well and strong.

Case 2. Mrs. F., aged 34, widow, was admitted to the gynecological service, Montreal General Hospital, on August 8, 1906, with rectovaginal fistula of two years' duration. Her history was rather interesting. Seven years previously she had recurrent and severe attacks of right-sided abdominal pain, which were regarded as appendicitis. For five years she suffered at intervals from these attacks, and finally a tumor developed at McBurney's point. She was operated upon in the Massachusetts General Hospital and informed that her appendix was removed. The incision was a median one, below the umbilicus. In three weeks she left the hospital but still complained of pain in the right lumbar region and was practically bedridden. Finally an abscess formed which pointed in the vagina and was opened in the anterior fornix by her own physician. Upon making the vaginal puncture, gas and fæces escaped with the pus and the fistula was established. So long as this discharged freely she was fairly free from pain, but if it tended to close she had severe pain referred to the region of the gall bladder. No marked fever and no jaundice. Six weeks before admission to the Montreal General Hospital she had a severe attack of this colic (biliary?), but no bile could be detected in the discharge from the fistula.

I saw her in consultation with the assistant gynecologist, the late Dr. John D. Cameron, and we thought that possibly an abscess, originating in the gall-bladder region, had burrowed down and formed a point of communication between some part of the bowel and the vagina. On August 25, 1906, I did an exploratory laparotomy, making an incision through the right rectus muscle slightly above the level of the umbilicus. The gall-bladder was found somewhat distended, but evidently not diseased, and was not disturbed. The cæcum was found bound down by strong adhesions at the pelvic brim and no attempt

was made to break these down. The abdominal incision was closed and the first stage of Madyll's colostomy was done in the left iliac region. Five days later the bowel was opened with the thermo-cautery in the ward, and she left the hospital on September 16th, with the artifical anus working well, and the vaginal fistula had already ceased to discharge. On November 19th, she returned for closure of the colostomy as the old fistula had never troubled her since she went home. The closure was accomplished in the manner described in the former case and she left the hospital on December 3d and remains well.

CASE 3. Mrs. B., aged 25, married, was operated on October 28, 1906, for double pyosalpinx, and five days later a fæcal fistula declared itself at the abdominal incision. A month later she went home and remained constantly in bed, but the fistula showed no sign of healing. On February 28, 1907, she returned, and I made a proctoscopic examination under ether anæsthesia. Upon injecting methylene blue solution into the fistulous opening at the abdominal scar, the blue fluid could be seen coming down into the upper end of the proctoscope but we could not get it high enough up to see the opening in the bowel, so we judged it must be in the upper end of the sigmoid. By injecting plumbage into the fistulous tract in considerable quantities and submitting the patient to the Röntgen rays the skiagram showed the correctness of that opinion. (The credit for this ingenious suggestion is due to Dr. J. L. Robinson, the house surgeon.) To carry out our plan of treatment in this case required a right-sided colostomy and accordingly the cæcum was opened on March 22d. She returned home on April 12th wearing a colostomy cup as usual and returned on October 12th for closure of the artificial wound. Her colostomy gave her much more inconvenience than any of the others, as was to be expected from a right-sided colostomy with its liquid and irritating discharge. Moreover the cæcum protruded through the opening much more than the sigmoid does and she had little sphincteric control. Notwithstanding these inconveniences she improved greatly in health and the fæcal fistula entirely closed in two months. The colostomy was closed in the usual way, and she left the hospital on the 21st day thereafter and remains well.

CASE 4. Mrs. Mac—, aged 57, married, mother of 12 children, admitted July, 1907, to the gynecological service suffering from double pus tubes. At operation dense adhesions to the bowel and bladder were found. Upon separating the left tube the upper part of the rectum was torn across, and an end-to-end anastomosis was done. But the walls were very friable and Dr. Lockhart feared the sutures would give way. He therefore used a fold of the broad ligament to shut off the suture line from the general peritoneal cavity and passed a gauze drain down into this cul-de-sac. The sequel justified his foresight, for eleven days later a fæcal fistula developed at the abdominal wound. In spite of rest and packing this persisted and she was transferred to my service for colostomy. On August 21st I operated and she went home in three weeks, but did not return until the following March, when she reported that she had no discharge from the old fistula since she left the hospital, but as she had good control of the artificial anus and was really very comfortable she had delayed coming back until it was quite convenient to herself. The colostomy opening was closed in the usual way, and she returned home in three weeks quite cured and has so remained.

THE QUESTION OF DIAGNOSIS IN THE CASE OF A PATIENT COMPLAINING OF "INDIGESTION"[1]

BY AGNES C. VIETOR, M. D., BOSTON

AT this initial meeting of a new section of the Society, it seems most useful to take a brief general view of the field which presents itself to the student of that which is only approximately correctly called *gastro-enterology*.

The broad gateway through which the larger number of patients from this field present themselves is labeled "indigestion." Under the term "indigestion" are commonly included all forms of discomfort in the abdomen, especially in that zone which includes the epigastrium and the two hypochondria, and which extends horizontally through the trunk to the back.

This discomfort may be one of *sensation*, the signal of derangement being carried by sensory nerves. Then it may occur as a more or less defined sense of local fatigue, up through the ascending scale of sense of weight; of pressure; of distension; of dragging; of aching — dull or sharp; of pain — dull or sharp, intermittent, remittent, or constant; of internal irritation, as of burning or of acrid-

[1] Read at the Meeting of the Section on Gastro-Enterology of the New England Hospital Medical Society, Boston, October 15, 1908.

ity — which the patient may call an internal "acidity"; of emptiness; of hunger; of nausea; of desire for pressure or heat externally by the hand, or the clothing, or the hot water bag, or internally through food or drink; of inactivity, as though the food lay heavy and motionless; of over-activity, as though the stomach rushed its contents onward and demanded more. And these discomforts may appear before, after, or during eating or drinking, or may be mitigated or aggravated by eating or drinking; or they may not be affected one way or the other by food or drink.

The discomfort may be one of *action*, the signal of derangement being carried through motor nerves. Then it may occur as an overactive, quiet or noisy, peristalsis, which may be felt or heard by the physician as well as by the patient; as an intermittent or remittent reversed peristalsis driving before it, through the esophagus, pharynx, or mouth, gaseous, solid or liquid gastric or duodenal contents — in the form of eructations of gas; or of regurgitation or vomiting of food, or of secretions, or of both; or as a decreased peristalsis, causing more or less arrest or detention of gastrointestinal contents.

These sensory and motor phenomena are usually accompanied more or less by some degree of related or reflex secretory, nutritive, visceral, circulatory, respiratory, neuro-muscular, or psychic disturbances.

For centuries, in the presence of these grouped phenomena, the medical profession and the laity have made a diagnosis of "indigestion"; and both have labored to increase the digestibility of foods and to increase or conserve the digestive powers of the patient. This line of thought and endeavor has been notable for its successes and for its failures.

The difficult branches of physiology and its twin sister, living pathology, have only slowly been able to shed light on the explanation of both the successes and the failures. Autopsies have steadily reported the existence of many anatomical conditions which are pathological, but only exceptionally could any connection be made between the existence of these conditions and the life history of the patient. This connection is now being made by laboratory and animal experimentation, corrected and enlarged by clinical observation and by modern aseptic surgery.

It is especially to the stimulus of these branches of the science and art of medicine that is due the present advancing knowledge which we possess of the physiology of the abdominal viscera, of the living pathology of these organs, of the anatomical and physiological compensations spontaneously set in action in these organs by variations from that which we call the "normal"; of the relation between the objective conditions and the subjective manifestations; and of the intermediate steps which precede the terminal lesions long noted in autopsies.

Correlation of the observations made along these different lines explains many of the above-mentioned successes and failures and already raises the strong presumption that the symptoms of so-called "indigestion" are really symptoms of definite pathological conditions, many of which can now be clearly recognized.

Anatomically, as may be seen by these three charts, we have not learned of any new viscus belonging normally in this middle zone of the trunk, but we have come to recognize that one or more of these well-known organs may change their location within this zone or may even depart from it altogether; and we have also learned that the viscera of the upper zone of the trunk, the thorax, may so descend, without entering the abdominal cavity, as to displace more or less these middle zone viscera; while the viscera of the lower zone of the trunk may so ascend as to form part of the contents of this middle zone, within the abdominal cavity, altering more or less the locations and relations of the organs belonging there.

We have further learned that this middle zone of the trunk, and especially that portion of it which we call the epigastrium, acts as a reflex alarm center for the whole body; and definite evidence exists that the pathological condition causing symptoms referred to this region may be found in any organ or tissue of the body; but it is especially liable to be found in connection with the abdomen; more particularly with one of the viscera lying in the upper abdomen, and especially one located

normally to the right of the median line in this region.

Hence, in attempting to locate a pathological condition causing symptoms in the middle trunk zone, errors are most likely to be avoided by first excluding:

1. All causes lying entirely outside of the abdomen — for example, tuberculosis; tabes; non-pancreatic diabetes; anæmia; all forms of toxemia; arteriosclerosis; lesions of the pelvic, thoracic, cerebral, or peripheral sense organs, etc.

2. All causes lying anywhere within the abdomen in a viscus normally belonging outside the upper abdomen or middle trunk zone — remembering that some of these outside viscera may be displaced upward into this zone; for example, affections of the jejuno-ileum, appendix, cœcum, the various segments of the colon, etc.

But before proceeding to the investigation of the abdominal viscera, the writer would urge the necessity of excluding:

3. All causes lying in the walls of the abdomen, which latter form the main defense of the viscera against external trauma and against dislocation and injury by gravity, traction, etc., for example, abdominal incompetence,[2] which may be due to incomplete or arrested development, to a beginning or advanced reversion, to neuro-muscular lesions, etc.

We thus arrive at the viscera normally belonging in the upper abdomen or middle trunk zone, remembering that these viscera may be displaced within the limits of this zone or that they may be displaced partially or entirely outside of its limits; and that if displaced they may be replaceable, irreplaceable, or immobilized by adhesions, etc.

For example, the stomach may be found to be normally located; it may be displaced as a whole; only the body may be displaced, the pylorus remaining in place; only the pylorus may be displaced, the body remaining in position; the greater curvature alone may be displaced; both greater and less curvatures may be displaced; and, finally, two or more of these conditions may be combined.

Again, the gall-bladder may be found anywhere from high up on the antero-lateral trunk wall inward to the region of the pylorus, and downward to the region of the umbilicus or appendix; and it may be adherent to any of the viscera which it meets in its wanderings, or to the abdominal walls.

And, further, the kidneys, especially the right, may be found anywhere between their normal location in the hypochondria (the right embraced by the liver, duodenum, and hepatic flexure of the colon; and the left, by the tail of the pancreas, spleen, and the splenic flexure of the colon) and the pelvis.

Considering the diagnosis with this anatomical, physio-pathological and clinical knowledge in mind, the first step will be to exclude all causes coming under (1) as just stated. In some cases, this can be done without great difficulty, while others will present some of the most obscure problems in diagnosis.

In all cases, however, no matter how clear may be the presumption that a sufficient cause exists elsewhere in the body, the diagnosis should not be considered established till affections of the abdominal wall and of the middle zone viscera are excluded.

The question of incompetence of the abdominal walls is of primary importance because, in the observations of the writer, this one factor is capable of producing such changes in the abdominal viscera as develop the conditions which logically underlie the development of the common affections of these viscera.

In studying the upper abdominal viscera, it must always be remembered that these viscera may be displaced within the limits of this zone, or that they may be displaced partially or entirely outside its limits; and also that no matter where they wander, their ultimate proximal attachments and their afferent and efferent vessels and nerves are still derived from the original sources in the upper abdomen.

[2] The abdomen may be said to be *competent* when its walls not only contain the viscera, but also retain them in position against gravity and other displacing forces. The principal characteristic of the competent abdomen is the intimate and exact correspondence existing between the viscera and the muscle walls, by which the latter always move in the direction required to retain and support the former. This muscle reflex is so active that there is a constant play of the muscles of the anterior, lateral, and posterior walls of the abdomen, adapting these walls to changing conditions of pressure and stress; and, against gravity, protecting these viscera from such conditions by interposing a firm muscle plane. The abdominal wall (and probably coincidently also the abdominal viscera) is a reflex center responding constantly to the activities of all portions of the body; the abdominal muscles being muscles of fixation especially for all the large muscles connecting the extremities with the trunk. In proportion as these reflexes are active and correctly associated, the evolution of the abdomen proceeds towards "normal" *competence*.

Hence, in both increased and decreased mobility of these, as well as of the other abdominal viscera, traction, kinking, and torsion on and of the viscera themselves and their attachments, on and of their afferent and efferent vessels and nerves, and on and of any adhesions that may be formed, cannot be excluded, and these processes have been observed in operation by the writer in a series of experiments as yet unpublished;[3] and the effects of the traction have been seen to extend to the viscus upon which the traction is exerted, through this viscus to its attachments, through these attachments to the related viscera and so, proximally, even to the trunk walls.

The pathological effects of displacement and of traction, kinking, and torsion, of tissues, of blood and lymph vessels, of nerves and of adhesions have been abundantly demonstrated elsewhere in the body. These effects lie in the direction of altered secretions; of atony; of obstruction and dilatation of cavities or canals; of trophic changes, even to ulceration and gangrene; of lowered resistance to infection; of inflammations of all grades; etc.

The subjective manifestations of this visceral traction, accompanied as it may sometimes be by kinking and torsion, are not yet demonstrated, within the limits of pronounced obstruction; but their existence cannot be doubted when one remembers the demonstrated effects of such conditions elsewhere; and it is from this ill-defined mass of symptoms of so-called "indigestion" that one is hopeful of some day isolating them.

Even now, the existence of an incompetent, and hence displaced, abdominal wall must lead one to diagnosticate a displacement of some of the abdominal viscera,[4] with the possibility of already-begun traction, with or without kinking or torsion.

And when some of the above symptoms disappear, as for instance when the effects of gravity (that great displacing force in the presence of an incompetent abdominal wall) are antagonized — as by placing the patient in the recumbent or inverted position, or by increasing the competence of the abdominal wall by increasing its reflex contractility or by supplementing its supporting power by external methods — then these symptoms must be interpreted as an outward expression of visceral displacement, with consequent traction, and perhaps kinking or torsion.

And, further, when this relation between abdominal incompetence and visceral displacement, with traction, kinking and torsion in the perspective, is borne in mind, and when one also remembers the tissue changes already demonstrated elsewhere as the result of such processes as traction, kinking and torsion, one cannot but question whether the more definitely demonstrated lesions of the upper abdominal viscera — atony, motor insufficiency, dilatation and ulcer of the stomach; duodeno-pyloric and duodenal obstruction and ulcer; chronic inflammation, obstruction and even stone formation in the gall-bladder and bile passages; and perhaps the related and obscure affections of the pancreas; and even appendicitis and other lesions in the lower abdomen — are not more remote effects of this traction, kinking and torsion.

And one questions this the more as one observes the frequency of occurrence of all stages along this consistent pathological line, as here drawn; as one observes the frequency of occurrence of all stages of the underlying factor of abdominal incompetence;[5] and,

[3] In displacement of the viscera, following abdominal incompetence, the writer has observed the spontaneous production of traction, with or without kinking and torsion, in all the abdominal viscera — upon the abdominal œsophagus; upon the body and antrum of the stomach and the first portion of the duodenum; at the body-antrum junction of the stomach; in the first portion of the duodenum just beyond its junction with the pylorus, as well as more or less throughout the first portion of the duodenum; in the lesser omentum, containing the bile ducts and the portal vein; on the gall-bladder, from the fundus to the neck; in the second portion of the duodenum; at the duodeno-jejunal angle; in the ileum, appendix, and all segments of the colon; in the pedicles of the kidneys; and upon all the solid viscera — liver, spleen, pancreas, kidneys, and adrenals.

[4] Given a cavity which contains no free space, and whose contents are movable; whenever the walls of the cavity are displaced, in whole or in part, its contents are displaced, in whole or in part.

[5] The writer has stated elsewhere her reasons for believing that the human abdomen is still in process of evolution — a stage of evolution with which the human race is at present struggling, and of which earlier phases can be traced backward through the vertebrate series and in human prenatal life; that this evolution, both visceral and parietal, is normally incomplete at birth; that the abdominal wall is normally incompetent at birth; that, in its highest form, it moves throughout infancy and childhood towards attaining competence at or before the age of puberty; that this competence is in the majority of cases never fully attained, and is in all cases unstable, tending constantly to reversion to more or less incompleteness; that this tendency to reversion is more pronounced with the approach of the fourth decade and beyond; and, finally, that abdominal incompetence is always accompanied by some degree of visceral ptosis, of which latter condition it is the fundamental cause. Transactions of the Fifteenth International Medical Congress, at Lisbon, April 20, 1906. Section in Surgery, pp. 279-304; and Boston Medical and Surgical Journal, August 9, and 16, 1906.

finally, as one observes that as abdominal incompetence increases, symptoms referable to the abdominal viscera (especially those in the upper abdomen) increase; while as abdominal incompetence is decreased, these symptoms decrease, except where such advanced tissue or organic changes have occurred as necessitate added surgical measures.

SUMMARY

1. Symptoms of so-called "indigestion" group themselves as sensory and motor phenomena referred to the abdomen, but especially to the upper abdomen or middle zone of the trunk, and accompanied more or less by some degree of related or reflex secretory, nutritive, visceral, circulatory, respiratory, neuro-muscular, or psychic disturbances.

2. For centuries, the diagnosis of "indigestion" has led to the treatment of these phenomena by efforts to increase the digestibility of foods and to increase and conserve the digestive powers of the patient. This line of thought has been notable for its successes and for its failures.

3. Correlation of the progressing observations made in laboratory and animal experimentation, corrected and enlarged by clinical observation and by modern aseptic surgery, explains many of these successes and failures; raises the strong presumption that the symptoms of so-called "indigestion" are really symptoms of definite pathological conditions; and already indicates many of the intermediate steps which precede the terminal lesions long noted in autopsies.

4. The most important recent anatomical observation in the study of these cases is the knowledge that the viscera normally present in the middle zone of the trunk are frequently displaced within or from it, while the viscera from the adjacent trunk zones may be displaced into it.

5. Directly related with these anatomical observations are the clinical and physiopathological ones that the middle zone of the trunk, and especially that portion called the epigastrium, acts as a reflex alarm center for the whole body, and that the pathological condition causing symptoms referable to this region may be found in any organ or tissue of the body but is especially liable to be found in connection with the abdomen, more particularly with the upper abdomen.

6. In attempting to locate a pathological condition causing symptoms in the upper abdomen, errors are most likely to be avoided by first excluding all causes lying entirely outside of the abdomen.

7. But no matter how clear the presumption that a sufficient cause exists elsewhere, the diagnosis should not be considered established till affections of the abdominal wall and of the abdominal viscera are in turn excluded.

8. The question of incompetence of the abdominal wall is of primary importance, because in the observations of the writer, this one factor is capable of producing such changes in the abdominal viscera as develop the conditions which logically underlie the development of the common affections of these viscera.

9. Incompetence of the abdominal walls is always accompanied by some displacement of the viscera.

10. No matter where the viscera are displaced, their ultimate proximal attachments and their afferent and efferent vessels and nerves are still derived from the original sources in the upper abdomen.

11. Hence, whenever the abdominal viscera are displaced, traction, with or without kinking and torsion, on their attachments cannot be excluded.

12. The pathological effects of displacement, traction, kinking and torsion have been abundantly demonstrated elsewhere in the body.

13. In the light of the foregoing, one can not but question whether the more definitely demonstrated lesions of the upper abdominal viscera — and even appendicitis and other lesions in the lower abdomen — are not more remote effects of this traction, kinking and torsion.

ACUTE TRAUMATIC TETANUS TREATED BY MAGNESIUM SULPHATE

With Report of a Case in the Treatment of Which Injections of an Aqueous 25 Per Cent Solution of Magnesium Sulphate were Made in the Spinal Subarachnoid Space; with Recovery

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OUR knowledge concerning this acute infectious disease is incomplete. Numerous are the features of this intoxication that call for elucidation. We know that the disease occurs sporadically, endemically (1), and epidemically; that there is no age, sex, or race that is immune. It has occurred in Iceland. It is very prevalent in the tropics. In reference to race incidence, it must be stated that it is considered by most observers to be more frequent in the dark-skinned races than in the white race, even in the same country. The disease has a variable period of incubation; on an average, from five to ten days elapse between inoculation and the appearance of the symptom-complex of this condition. A short period of incubation implies intensity and virulency of infection, and is of bad prognostic omen. Though it is not believed that one attack confers immunity against other attacks, cases of second attacks are not known (7).

Though this disease is comparatively rare, it occurs in such unforeseen (8) conditions, and usually has such a dramatic outbreak and such a fatal termination, that it is of interest to all medical practitioners. It has complicated burns (2). It has complicated frost-bites. It has followed such insignificant trauma as is associated with the hypodermic injections of quinine (3), with the subcutaneous administration of antiplague serum (4), with the application, for hemostatic purposes, of gelatine to bleeding surfaces, with the subcutaneous employment, for hemostatic or other purposes, of this same agent (5), with the operation of vaccination (6), of circumcision of the removal of adenoids, it has followed the employment of contaminated catgut in operative procedures, it has followed contused wounds of the outer canthus of the eye (9), and other wounds so insignificant that at the time of infection they passed unnoticed, or if noticed, they were completely forgotten at the time of the outbreak of the disease. The disease may occur after childbirth, and may occur after abortion, accidental or induced (10). As a result of fourth of July injuries in 1903, there were 406 deaths from tetanus as compared with 60 from other sources (11).

Since the discovery by Nicolaier, in 1885, of the baccillus tetani, and its growth, in pure cultures, by Kitasato, in 1889, it has been amply demonstrated that all clinical forms of tetanus; cephalic tetanus (12), tetanus neonatorum (13), puerperal tetanus (14), post-operative tetanus (15), traumatic tetanus, are due to the bacillus tetani. The inoculation of the offending germ occurs through an abrasion or wound of a cutaneous, or a mucous surface. Tetanus is an implantation infection. In the lower animals, all experimental efforts to produce the disease, through either the respiratory or the alimentary tract, have proved unsuccessful. In man, as far as we know, the same condition obtains. No case is on record of the disease occurring in man, in which infection took place by inhalation or ingestion of the tetanus bacilli. The bacillus, though not a pyogenetic germ, is not hindered in its development by the germs of suppuration. The latter, in fact, create condition favorable for its growth (16). As a wound complication, the frequency of tetanus has markedly lessened since the generalization of the antiseptic treatment of wounds.

The disease has no characteristic pathological anatomical changes (that, is none have to this date been determined, or rather, demonstrated). No constant changes have been found either in the peripheral nerves or in the cerebrospinal nervous system.

The diagnosis offers no difficulties. In all but the chronic cephalic forms of the disease,

the mortality is appalling. In an editorial in the Journal of the American Medical Association (16a) it is stated that "the usual rate of mortality for traumatic tetanus is probably about 80 per cent." Stewart (17) says that "the mortality is greatest in the puerperal type, extremely few cases recovering. It is said that recovery is almost unknown in tetanus after abortion." This high mortality is due to the fact that the measures actually employed in the treatment of this disease are ineffective. It is notorious that the drug treatment of this disease has been without efficacy. Many are the medical agents that have been employed in tetanus. The indication for their employment has been found chiefly in the controlling or depressing influence which they exert upon muscular action. Opium (18), carbolic acid (19), physostigmine (20), the bromides and chloral hydrate (21), can be mentioned among the drugs that have been, and still are, employed extensively in the treatment of this disease. These drugs meet isolated symptoms of this disease, more or less successfully. Recoveries from tetanus infection are reported in which the medical attendants attribute the happy termination of the disease to the employment of one or more of the aforementioned drugs. Apparently, none of these drugs exercise much influence upon the course of severe cases. Very mild cases recover with, perhaps despite, any of the various forms of treatment.

For prophylactic and for curative purposes, antitetanic serum is widely employed. Different routes are employed to introduce the liquid serum into the human organism. The injections of the serum may be subcutaneous, intramuscular (21*a*), intravenous (22), intraneural (23), intracerebral (24 and 30*a*, Girard), or intraspinal (25). In the intraspinal method, some clinicians introduce the antitetanine in the epidural space (26); the majority, however, make the injection in the spinal subarachnoid space. In all wounds of a suspicious nature, such as those in which there is much contusion of tissue, such as are soiled with street-dirt or garden-earth, in all gunshot wounds, in wounds occurring in individuals who work around horses, in horseshoeing establishments, or in stables, it is the practice of most surgeons to inject for prophylactic purposes in the wounded individual from 2,000 to 3,000 units of antitetanic serum. The sooner after the injury the serum is injected, the greater is its protective power, the greater is its prophylactic potency. For the last 10 years, in all individuals having wounds of the nature described above, I have injected for prophylactic purposes invariably, antitetanic serum. I have never seen a case of tetanus occur after attempted immunization. It must be stated, however, that, lately, the immunizing properties of antitetanic serum have been disputed. Some cases of tetanus have been reported showing that antitetanic serum is not invariably successful in preventing the outbreak of the disease. Jacobson and Pease (21*a*) were able to collect six cases occurring in the United States and Canada, in which tetanus developed, despite the prophylactic use of antitetanic serum. In all but one of these cases, recovery ensued. Reynier (27), was able to collect from the literature thirty-one other cases of tetanus that had developed subsequently to attempted immunization by prophylactic injections of antitetanic serum. To these, he added one personal case. In this series, though the antitetanic serum did not prevent the disease, it, apparently, in most of the cases, attenuated the symptoms and positively lessened the mortality rate. In the lower animals, the immunizing properties of antitetanic serum have been repeatedly demonstrated. In laboratory experiments, the serum being usually injected either simultaneously with, or immediately after, the injection of the toxin, neutralization is easily effected and tetanus does not develop. Owing to the employment of antitetanic serum by veterinarians, as a preventive of tetanus, this disease as a wound complication after castration of horses has almost completely disappeared. In the human subject, the immunizing properties of antitetanic serum are not as universally acknowledged.

As in immunizing doses, antitetanic serum is perfectly innocuous, we urge, until more light be thrown on the subject, that it be employed as a prophylactic agent against tetanus. Schwartz (30*a*) in 300 injections noticed no other accident but an occasional erythema

(5 cases). In the opinion of many clinicians, its value as a preventive of the disease is established (30). Delbet, Demoulin (27), and Kummer (28), and innumerable other observers, have never seen tetanus develop in a patient to whom, shortly after the infliction of his injury, an immunizing dose of antitetanic serum had been administered. It must be stated, however, that the value of antitetanic serum, as a prophylactic agent, is based on belief, on clinical observation, and not on scientifically demonstrated facts. In the Paris hospitals (27) prophylactic injections of antitetanic serum were not employed between the years of 1886-1890, inclusive. During the years 1901-1905, inclusive, the prophylactic injections were employed in nearly all, if not all, the Parisian hospitals. The serum during this same period was also extensively employed as a curative agent. During this period there occurred in Paris, 153 deaths from tetanus.

In the prophylactic treatment of tetanus, in addition to the administration of antitetanic serum, all suspicious (suspicious from the standpoint of tetanus development) wounds should be subjected to vigorous and thorough antiseptic treatment. Lowering of vitality by bruising, and incorporation of foreign material, favor but are not essential for the development of tetanus. Like all sporulated microbes, the bacillus of Nicolaier offers great resistance to the action of antiseptics.

The following table is taken from an article by Scherck (29). It constitutes quite a forcible plea for the prophylactic employment of antitetanic serum.

Cases of Fourth of July injuries treated in the city dispensaries of St. Louis:

Years	No. case	Antitetanic serum	Death from tetanus
1903	56	no	16
1904	37	yes	none
1905	84	yes	none
1906	170	yes	none

In the treatment of numerous cases of tetanus occurring in the human subject, antitetanic serum has been employed. In many cases thus treated, recovery ensued. It is conceded, however, that in the great majority of cases in which this agent has been used, whatever may have been the route of introduction of the serum into the human system, the results have been disappointing. The cases have terminated fatally, not on account of the administration of antitetanic serum, but because of the inefficacy of the latter as a curative agent for tetanus. So extremely unsatisfactory have been the results attending its use, that though still extensively employed, it is regarded as inefficacious by all, being employed for want of a better agent. The serum exerts but little influence on the course of the malady, and despite its use, the large majority of cases result in death.

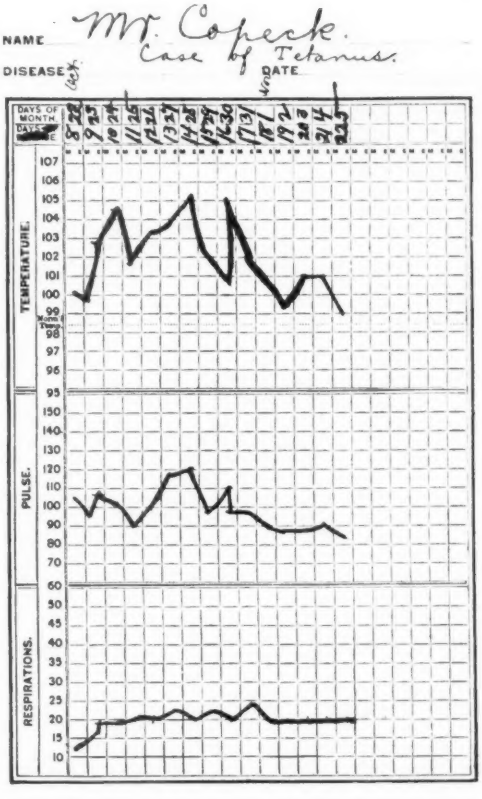
Jacobson and Pease (21*a*) say, "It is apparent that after tetanus is fully established, serum therapy, however administered, promises but little as a curative agent." In a discussion before the Société de Chirurgie de Paris (27), in which most of those present participated, the opinion was general that, as a curative agent for tetanus, antitetanic serum in the human subject is of doubtful efficacy. Calmette, himself, expresses the opinion that antitetanic serum has no curative power, but that in chronic tetanus, it markedly shortens the duration of the illness. The report of a case, in which a comparatively new mode of treatment has been employed with success, finds its justification in the fact that in the present state of our knowledge all forms of treatment, in this disease, are extremely unsatisfactory.

Mr. Otto Copeck, 17 years of age, Bohemian by birth, was admitted to the West Side Hospital on October 22, 1908. Eight days previous to admission he had stepped upon an old, rusty horseshoe nail, thereby sustaining a punctured wound of the left foot. Though no attempt at disinfection had been made, this punctured wound, about a inch in depth, had by the time of admission, healed by first intention. Two days before admission, patient suffered from general malaise. On October 21st, neck began to feel stiff and sore, and patient began to experience some difficulty in opening his mouth. On the morning of October 22d, Dr. Vasumpaur was called, examined the patient, and made a diagnosis of acute traumatic tetanus. He gave a subcutaneous injection of 2,500 units of antitetanic serum, and ordered that an ambulance be called, and that the patient be conveyed to the hospital and placed under my care. When I first saw the case, the manifestations of the disease were so classical that the diagnosis of tetanus was self-evident. There were present trismus, retraction of the head, marked rigidity of the cervical, thoracic, and abdominal muscles, opisthotonos, etc. The angles of the mouth were drawn outward and downward, the upper lip firmly pressed against the teeth, producing the facial expression which is

almost invariably present in this disease. The voice was feeble. Slight disturbance of the patient, as by loud talking, opening and closure of the door, etc., would excite convulsive seizures of about 10 seconds' duration. The patient remained in the hospital 28 days. The period of convalescence began on the 10th day after admission to the hospital and was uneventful. His treatment after the first ten days consisted merely of careful nursing. During the first eight days of the active stage of the disease, patient suffered from retention of the urine. The application of fomentations to the hypogastrium having failed to relieve the condition, he was catheterized three times daily from October 22d to Nov. 2d. No vesical disturbance resulted. During this same period patient was obstinately constipated. Cathartics per mouth and rectal enemata being without influence, resort was had to the subcutaneous administration of physostigmine in doses of gr. 1-100, and relief was thereby obtained. In the acute stage of the disease, two such doses were taken. In the first few days, attempts to give enemata would provoke convulsive seizures.

From October 22d to November 2d, inclusive, patient's diet was wholly liquid. On the evening of November 6th, he was started on semisolid food. On the 19th of November he was discharged. During the active stage of his illness, our patient received, to combat insomnia, an occasional dose of morphine. On admission into the hospital, 4,500 units of antitetanic serum were injected in the spinal subarachnoid space, 1,500 units subcutaneously around the left sciatic nerve, just beneath the gluteal fold, 1,500 units in the region of the anterior crural nerve, about an inch below Poupart's ligament. On October 23d, 7,500 units of serum were injected subcutaneously. On October 24th, 6,000 units were introduced in the spinal subarachnoid space. On October 25th, 6,000 units were injected in the subarachnoid space, 1,500 units in the left foot, in the region of the wound of inoculation, and the same amount around the left sciatic nerve. On October 26th, 6,000 units were injected in the subarachnoid space, and 1,500 units subcutaneously around the left sciatic nerve. On October 28th, 4,500 units were given subarachnoidally, 1,500 units in the left sciatic nerve, and 1,500 units in the left foot. On October 30th, again 6,000 units were injected into the spinal subarachnoid space, and 3,000 units subcutaneously.

All the injections in the subarachnoid space were made either through the interspace between the spinous processes of the 3d and 4th lumbar vertebræ, or through that between the 4th and 5th lumbar vertebræ. For these injections, as well as for those of the aqueous solution of magnesium sulphate, anesthesia was not used. Anesthesia is not necessary. General anesthesia is decidedly harmful in these cases. It has determined deaths. Five injections, each of 5 c.c., of an aqueous 25 per cent solution of magnesium sulphate, were introduced into the spinal subarachnoid space. The path of injection was the interspace between the spinous processes of the 4th and 5th lumbar vertebræ. The needle was inserted about 2 cm. to the side of the median line, on a level with an imaginary line



Second line of figures above indicates the day of onset of symptoms.

extending between the highest point of each iliac crest. None of the solution was injected until a few drops of clear nonblood-stained cerebrospinal fluid had escaped.

The magnesium sulphate injections were made on the 23d, 25th, 26th, 28th, and 30th of October. Each injection was followed by marked lessening of muscular rigidity and noticeable improvement in the patient's general condition. Upon reappearance of the symptoms to an extreme degree, the injections would be repeated. After the first injection, the rigidity of the lower limbs never returned to any but a slight degree. I cannot but be of the opinion that the magnesium sulphate was a contributory factor to the patient's recovery.

Previous to our employment of magnesium sulphate, it had been used by other clinicians. Their cases follow. In some of these cases, death occurred; in others, recovery followed. The cases as yet are too few in number for any definite opinion to be expressed as to its value. A more exact dosage must be determined.

Greater proficiency in administering must be obtained. The results, however, have been sufficiently encouraging to warrant, in fact, to demand, further study of the subject. The experimental work on this subject has been done chiefly, almost wholly, by Meltzer & Auer (31). They determined that intraspinal injections of magnesium salts are capable in monkeys of abolishing completely, at least temporarily, both tonic and clonic tetanic contractions. Clinically, experiments seem to partially bear out the further statement of these investigators that intraspinal injections of magnesium sulphate in doses which do not affect the respiratory center or other vital functions, are capable of abolishing completely all clonic convulsions and tonic contractions in cases of tetanus, occurring in the human subject. The relaxing effects of the injections may last 24 hours or longer. In the case which I report, none of the vital functions were influenced by the intraspinal injections of magnesium sulphate. In some parts of the body, such as in the lower extremities, the muscular relaxation following upon the injections was complete. In other portions, such as the mandibular, facial, or cervical muscles, the rigidity was very much lessened, but it was not completely overcome. Was it due to insufficient dosage, I am unable to state. Appended to the article is a temperature, pulse, and respiratory chart, in the perusal of which it will be seen that the injections at times were followed by an elevation of temperature. This has been noted by other observers. In Miller's (33) case, the injections determined a profuse secretion of mucus, bronchorrhea, at times severe enough to embarrass respiration, but easily controlled by atropine. Was there a relation of cause and effect between the injections and elevation of temperature? This must also be decided by further study of the subject. Meltzer and Auer (32) have determined that when administered by the intravenous route, the magnesium salts are very toxic, and that even small doses completely inhibit the respiration. Therefore, for the administration of these salts, this route, the intravenous route, should never be employed. We employed the agent only in the shape of injections in the spinal subarachnoid space.

In all of the tabulated cases, the magnesium sulphate was injected in the subarachnoid space. The solution has also been used subcutaneously in the following three cases.

Lyon (35) reports the case of tetanus, in the treatment of which magnesium sulphate was employed subcutaneously in which the incubation period was eight days. Two drams of magnesium sulphate were given on the 11th, 13th, 14th, 17th, and 19th days. The patient recovered.

Greeley (36) employed, with success, magnesium sulphate in solution in two cases of tetanus. After an incubation period of 10 days, the symptoms appeared. Greeley administered 7,500 units of antitetanic serum. By hypodermoclysis, one pint of distilled water containing 2 drams of magnesium sulphate was introduced into the organism. This was repeated on the next day. Recovery followed.

Greeley's other case was one of chronic tetanus. Four weeks elapsed between the inoculations and the outbreak of the symptoms. Wm. Hessert (34) a few weeks ago showed to the Chicago Medical Society a case of acute tetanus successfully treated with subarachnoidean injections of an aqueous 25 per cent solution of magnesium sulphate.

We cannot, and we are unwilling to, make any statement as to the value of magnesium sulphate as a therapeutic agent in the treatment of tetanus. The cases in which this agent has been used are, as yet, too few in number to allow the expression of an authoritative opinion. Further laboratory experiments and numerous clinical reports are needed. The animal experiments conducted by Cruveilhier (37) are too few to be conclusive. His findings are contradicted by clinical observers. We would refer the reader to the tables. The faith which Cruveilhier reposes in antitetanic serum as a curative agent is not warranted by the results that this agent has yielded.

We used magnesium sulphate, in the method stated above, in our case, and the results were so surprising and so satisfactory that we feel justified in urging its use in tetanus. It is important that the utility and the value of this drug as an agent to control the tonic and clonic muscular contractions so characteristic of this disease be exactly determined. Its value must be decided by the combined experience of clinicians the world over.

CASES OF TETANUS IN THE TREATMENT OF WHICH SUBARACHNOID INJECTIONS OF AN AQUEOUS SOLUTION OF MAGNESIUM SULPHATE HAVE BEEN EMPLOYED

	Sex, Age, Weight.	Period of Incubation. Previous Immunization. Nature of Wound.	Other Treatment.	Magnesium Sulphate Treatment.	Result.	Comments.
1. Blake, Jos. A. The use of magnesium sulphate in the production of anæsthesia and in the treatment of tetanus. Surgery, Gynecol. and Obst., Chicago, 1906, vol. ii, p. 541.	Male, 15 yrs., 115 lbs.	7 days. None. Crushed first three fingers of left hand.	Antiseptic disinfection of wound. On 3d day of disease (10th of injury) 40 cm. of antitetanic serum injected in spinal cord between 4th and 5th cervical vertebræ. 20 c. c. injected in median cephalic vein. On night of same day 20 c. c. injected in median basilic vein. On 11th day after injury, 35 c. c. of antitetanine serum injected in spinal canal by lumbar puncture. Chloral hydrate and morphine given when patient not under the effect of magnesium sulphate.	On 12th day after injury intraspinal injection of 4.5 c. c. of magnesium sulphate (25 in 100 of water). 33 hrs. later repeated injection. 37½ hours later intraspinal injection 8 c. c. of a 12½ per cent solution of magnesium sulphate. 27 hours later repeated above injection. Six days after repeated same injection.	Recovery.	Injections have a marked effect in restraining the convulsions and relieving pain, thereby conserving strength and preventing excessive metabolism and heat production.
2. Markoe, F. H. Reference same as case I, p. 549.	Male, 4 yrs., 40 lbs.	7 days. None. Sloughing wound of skin and subcutaneous tissue of the right leg.	Four injections each of five c. c. of antitetanine serum were injected into buttock, the external jugular vein, the spinal canal, and back respectively. Occasional doses of morphine and chloral.	1.5 c. c. of a 25 per cent solution of magnesium sulphate were slowly injected into the subarachnoid space.	Died 28 hours after 1st symptom of disease appeared.	Death cannot be attributed in the slightest degree to the magnesium sulphate. On autopsy cultures of tetanus bacillus were obtained from the wound, spleen, and heart blood, showing a marked tetanus bacteriæmia.
3. Logan, Samuel. The treatment of tetanus by intraspinal injections of magnesium sulphate for the control of convulsions. Jour. A. M. A., 1906, vol. xlvi, p. 1502.	Male, 11 yrs., 80 lbs.	8 days. None. Gunshot wound of hand with old toy pistol loaded with blank cartridge.	Simple cleansing of wound after development of the disease. On day of admission 50 c. c. of antitetanic serum injected intraspinally. Chloral hydrate, gr. 15, sodium bromide, gr. 30, every 4 hours. On 3d day after admission 10 c. c. antitetanic serum injected in each brachial plexus, in each sciatic nerve, and into the tissues around wound, in all 50 c. c.	On 3d day after admission general anæsthesia. 4 c. c. of a 25 per cent solution of magnesium sulphate injected in spinal canal by lumbar puncture. On 4th day again gave patient genl. anæsthesia and inject. in sub arachnoid space by lum. punct. 50 minims of 25 p. c. sol. magnesium sulphate.	Death 40 hours and 50 min. after 1st inj. of mgs. .40. Heart failed before respirations affected.	Temp. post-mortem 108.2F. per rectum. Complete cessation of muscular convulsions following introd. of magnesium sulphate.
4. Logan, Samuel Reference same as above.	Female, 24 yrs.	17 days. None. Vaccination.	100 c. c. of antitetanic serum injected subcutaneously. 30 hrs. after appearance of first symptom wide excision of vaccination wound, and dusting surface with dried antitetanine serum.	30 hours after first symptoms were noticed 4 c. c. of a sterile 25 per cent solution of magnesium sulphate were injected into spinal subarachnoid space by lumbar puncture. Local anæsthetic employed. 17½ hours later injection was repeated.	Death 50 hrs. after appearance of first symptoms.	No good resulted from the use of the magnesium sulphate solution. Patient was moribund when 2d injection of mag. sulp. was made.
5. Franke, Margan. Ein Fall von tetanus behandelt mit intra duralem injectionen von magnesium sulphuricum. Zentral. fuer Innere Medicin, 1907, vol. xxviii, p. 344.	Male, 32 yrs.	12 days. None. Wound of the middle finger.	Energetic antiseptic handling of wound is recommended by this author. Amputation of finger. Chloral hydrate, gr. 30 per rectum daily.	91 days after infliction of injury, intradural injection of 1 c. c. of sterilized 25 per cent solution of magnesium sulphate. 5 days after above intradural injection of 2 c. c. of same solution. 4 days later repeated same injection. Injecting needle broke in tissues. Removed by operation.	Recovery.	Franke noticed after each injection of mag. sulphate that there was a lessening of contracture, also noticed that the injections exerted a beneficial action on the muscular convulsions. Sleep was better. Nourishment possible.

6. Robinson, G. Canby. Treatment of tetanus by intraspinal injections of magnesium sulphate. Jour. Am. Med. Assn., 1907, vol. xlix, p. 493.	Male, 11 yrs. 67½ lbs.	Contusion of scalp. None. Played considerable around stable.	Excised supposed wound of entrance Chloral hydrate, gr. 30, sodium bromide, gr. 60, every 24 hrs. for the first two weeks.	On the 11th day of the disease patient was anæsthetized. Ethyl chloride used as a general anæsthetic. 3 c. c. of a 25 per cent solution of magnesium sulphate injected in subarachnoid space. On the next day repeated injection using 3½ c. c. On 15th day of disease injected in same locality 4 c. c. of same solution.	Recovery.	Author states that the intraspinal injections of mag. sulphate produced marked lessening of the very severe symptoms for a number of hours. The muscular rigidity was never so severe after each injection as it had been before.
7. Meltzer, S. J., and Auer, Jno. The Journal of Experimental Medicine, 1906, vol. vii, p. 795.	Male, 35 yrs.	4 days. Insignificant wound of foot which healed rapidly.	Large doses of antitoxine and sedatives gave no relief. 2 hours before death, an intravenous injection of antitoxine serum was injected.	One intraspinal injection of magnesium sulphate 1 c. c. to every 18 lbs. of body weight.	Death 5 hrs. after injection of mag. sulph. solution in subarachnoid space.	Anæsthetising and relaxing effect complete. Respiration good to end.
8. Miller, Robert T. Treatment of tetanus with subarachnoid injections of magnesium sulphate. The Am. Jour. of the Med. Sciences, 1908, vol. cxxxvi, p. 781.	Male, 7 yrs., 60 lbs.	7 days. None. Lacerated wound of left hand.	Antitoxin daily for 14 doses varying from 1,500 to 7,000 units. Sedatives for a short time. Copious saline enemas and infusion.	11 lumbar punctures made within 13 days. Approximately 2.5 c. c. of a 25 per cent solution of magnesium sulphate being injected into the meninges at each puncture.	Recovery.	"Of the value of the treatment by magnesium sulphate, no one who witnessed this case has any doubt." The muscular paralysis following each injection lasted from 18 to 29 hours. It involved all muscles, except those of head neck, and diaphragm. The injections were followed several times by respiratory collapse lasting 11 to 14 hours and the pulse dropped, though not to a dangerous degree.
9. Henry, Jno. Norman. International Clinics, 1908, Series 18, vol. iv, p. 1. Case I.	Male, 9 yrs.	6 weeks. None. Abrasion of skin of back by kick of horse.		Lumbar puncture 3 c. c. of 25 per cent solution of mag. sulph. injected in subarachnoid space. 5 days later subarachnoid injection repeated.	Recovery.	The case was a severe one. Made an excellent recovery. Each injection was followed by a relaxation of the rigidity.
Case II.	Male, 19 yrs., 123½ lbs.	7 days. None. Stepped on a nail. At time of admission, the wound was healed.	Wound of foot excised.	Lumbar puncture 6 c. c. of sterile solution of mag. sulph. injected into spinal canal. Ethyl chloride used as anæsthetic.	Death. Admitted July 30th, died Aug. 2d.	One hour after injection patient was entirely relaxed. A rise of temperature followed the intraspinal injection.
Case III.	Male, Colored, 9 yrs., 55 lbs.	6 days. None. Stepped on nails with both feet and inflicted punctured wounds.		Lumbar puncture. 4 c. c. of clear spinal fluid withdrawn. 2½ c. c. of 25 per cent sol. mag. sulph. injected into spinal canal. Two days later repeated injection, only gave 2 c. c. at second injection.	Death	A rise of temperature followed each injection.
Case IV.	Male, 45 yrs.	3 weeks. None. Stepped on nail.	On same day as second subarachnoid injection, 18 c. c. of antitetanus serum were given subcutaneously. On the morrow, 30 c. c. of antitetanic serum were injected into the left buttock.	6 c. c. of 25 per cent solution of magnesium sulphate injected into subarachnoid space by lumbar puncture. 3 days after above, performed lumbar puncture, removed 35 c. c. of clear spinal fluid, and injected 6 c. c. of sol. of mag. sulph.	Death on evening of 2d day following second injection.	"It is very much a question whether the mag. sulph. did not contribute to the patient's death."

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TEMPORARY VENTROSUSPENSION OF THE UTERUS

Its Technique, Indications, and End Results[1]

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PERMANENT ventrofixation of the uterus was in great favor with gynecologists between the years 1886 and 1896, when Noble (1) was the first to point out several of its most serious dangers. Now I believe its employment in child-bearing women is rarely recommended. The only notable exception to this which we were able to find is a recent article by Olshausen (2), who still favors its employment.

After ventrofixation came into disfavor, permanent ventrosuspension became popular, but even this operation, while it still finds a champion in Polak (3), is nevertheless proven to be not entirely without danger, and in the recent articles of Peterson (4) and Cragin (5) three cases are reported in which its employment subsequently necessitated Cæsarean section. So strongly are these two writers opposed to this operation that they condemn it most emphatically. The exact words of Peterson are, "The fact that one never can say definitely that a woman will be free from serious dystocia should she become pregnant after ventrofixation or ventrosuspension is enough to condemn the operation in the eyes of the conscientious surgeon."

The objections to permanent ventrofixation and suspension have repeatedly been enumerated in the literature. The reasons which have appealed most to me personally and because of which I have never done either in a child-bearing woman are: first, that they may interfere seriously with subsequent pregnancies and labors; second, that they offer a very considerable chance for subsequent intestinal obstruction; third, because in recent years more effective and less objectionable methods have been devised; and finally, because I have always had an aversion to permanently fixing normally movable intra-abdominal organs.

The well-merited disfavor with which permanent ventrosuspension and fixation are now regarded should not prejudice us *a priori* against a temporary suspension which has all of the advantages and none of the objections of the former. For many years abdominal surgeons have been looking for some method which would prevent adhesions between the uterus and the pelvic floor after the evacuation of large pelvic abscesses and infected tubes. This idea is well expressed by Olshausen (2), who says, "The fixation in a proper position of the freed and replaced uterus should, however, be a feature of the operation, as otherwise it may be assumed with tolerable certainty that the retroflexion will recur, and that the more or less wounded posterior surface of the uterus will again acquire attachment." So far as I have been able to ascertain, none of the operations previously employed have been entirely satisfactory. Thus for instance, Graves (6) reports the end results in five hundred cases of retroversion of the uterus treated by various operative procedures. He found 9 per cent recurrences in 267 cases of ventrosuspension and fixation, 13 per cent recurrences in 191 cases of Alexander's operation, and 31 per cent recurrences in 35 cases of internal round ligament shortening.

About twelve years ago the discussion was at its height, as to whether it would not be better to adopt the routine procedure of removing all of the internal sexual organs, including the uterus, when operating for these extensive pelvic abscesses, and this operation has recently again been advised in the writings of Kelly (7), Bovee (8), and Metcalf (9), and within the past year by Boldt (10), in spite of the fact that it has numerous serious objections. Boldt (10) in the February 1, 1908, issue of the Journal of the American Medical Association, says, "If it is necessary to sacrifice both ovaries, then the uterus should be extirpated." I think you will agree with me that if the same

[1] Read at the Meeting of the Southern Surgical and Gynecological Association at St. Louis, Dec. 16, 1908.

Drawing showing technique of operation

or better results can be obtained without sacrificing this organ, we should not extirpate it in these cases, because it certainly will increase the shock to these already devitalized patients; it opens up extensive fresh areas for infection and absorption; it favors weakening of the pelvic floor, for if the infection is still active we cannot be sure that the round ligaments will become firmly united to the stump of the uterus, even if they are carefully fastened to it; and finally, the operation is objectionable because it is contrary to our modern tendency to conserve this organ whenever possible.

Knowing these objections, numerous operators have devised various methods of intra-abdominal shortening of the round ligaments, and have paid much attention to carefully covering over the raw surface with peritoneum whenever this was possible, also placing the sigmoid behind the uterus and the omentum over everything. Emerson (11) uses permanent ventrosuspension as a routine measure in cases in which the ovaries and tubes have been mutilated, even if no previous displacement has existed, and he argues that after the tubes and ovaries have been removed, the uterus if left behind is very apt to fall back into the pelvis, where it becomes firmly fixed. Boldt (10) in the article above referred to goes even further, and says if both ovaries are not removed "not infrequently a ventrofixation of the uterus may become a desirable adjunct to other surgical treatment."

However, as none of these operations and precautions, except the last one, seem to be successful in a sufficiently large per cent of cases, judging from the number of cases I see annually who have previously had abdominal work for pelvic infection, and in whom the uterus is retroverted and firmly adherent to the sacrum, acting as a plug to the pelvic outlet, I believe we are justified in concluding that either the methods above cited are not generally enough employed or efficiently performed, or that even when properly used are not able to accomplish what they are intended for in a sufficiently large per cent of cases.

In order to prevent these undesirable after effects, I have devised a method which I have used with great satisfaction for about seven years, and while the method may not be original, Dr. Hench and myself in looking up the matter rather carefully have not been able to find it described anywhere.

It occurred to me years ago that if one could secure a temporary ventrosuspension of the uterus in practically every case of extensive pelvic infection in which a radical operation is performed, the problem would be solved, and it was with this end in view that the operation which will subsequently be described was devised. I think we will all agree that if this can be accomplished in practically every instance, it is much to be preferred to a hysterectomy or to permanent ventrofixation or suspension.

Broadly speaking, I believe the operation is indicated in every laparotomy for pelvic trouble in the female in which there is subsequent danger from retroflexion and adhesion of the uterus, and in which the Gilliam operation or some one of its recent modifications is not applicable.

I am informed that Gilliam himself strongly advises against using his operation if infection is present at the time of operation, because there is too much danger of causing extensive infection of the abdominal wall, and I believe most surgeons who have adopted the Gilliam operation or one of its modifications have heeded this advice.

To specify the indications a little more clearly, I would say that it is specially applicable in cases with large pelvic abscesses, where large denuded areas are bound to remain after the evacuation of the abscess and removal of the infected organs, and also in cases of pyosalpinx, ovarian abscesses, old extrauterine pregnancies, and appendical abscesses with leakage into the pelvis, in which the uterus shows a marked tendency to drop back into the pelvis when all the intraabdominal work is completed.

The technique of the operation is as follows: In laparotomies where it seems probable that this temporary ventrosuspension will be desirable, the laparotomy incision is made so that at the lower angle the skin incision is distinctly the longest, then the fascia and muscle, and finally, the peritoneal wound being the shortest. After the intraabdominal work is completed, a needle armed with a double strand of ten-

day catgut is introduced through the left rectus fascia about half an inch below the lower angle of the fascial incision, then through the left rectus muscle, and finally through the peritoneum about an inch below the lower angle of the peritoneal incision. It is now passed through the uterus about an inch behind the apex of the uterus, taking a good bite and being careful not to abrade the peritoneal covering of the uterus. The needle is now passed out of the right side in reverse order to its introduction on the left, and the stitch is tied just tight enough to bring the uterus in contact with the inner surface of the peritoneum, but not tightly enough to cause destruction of the peritoneum from pressure. The sigmoid is now carefully placed behind the uterus, and the omentum spread over this, covering all of the raw surfaces, which it may have been impossible to cover with peritoneum. The wound is now closed in the ordinary manner.

The most important point in the operation is to get the unabraded uterus in contact with the unabraded parietal peritoneum, there then being only two needle punctures in each where the continuity of the peritoneum on one side and the peritoneal covering of the uterus on the other is interrupted.

We are beginning to learn that permanent intraabdominal adhesions occur only when two raw surfaces come in contact. By protecting the omentum carefully during the operation and thus preventing abrasions of its endothelium and by bringing the uterus forward as just described it is possible to complete the peritoneal toilet in such a manner that no two structures which have lost their endothelial covering will be left in contact. While healthy endothelium will glue itself fast to abraded surfaces temporarily, it will prevent the connective tissue cells of one structure from intermingling with the connective tissue cells of the other structures, and of course this is the only way of getting permanent adhesions. We have also learned that temporary adhesions between the various intraabdominal organs, if not too extensive, are not at all serious, and that the least objectionable of these are adhesions between the omentum and sigmoid, or between either of these and any of the other organs.

If the operation is performed as above described, there is no danger of a permanent ventral fixation or suspension, while on the other hand the uterus will be held forward until the abraded areas have had an opportunity to heal over, or to be covered by such structures as the sigmoid and the omentum. If the omentum has not been injured, it will soon free itself again, and if a few permanent adhesions should form between the sigmoid and the uterus, they are not likely to cause serious trouble. Furthermore, this temporary ventral suspension will give the round ligaments an opportunity to contract and regain their tone, and when the time comes they will be capable of performing their duty in giving the uterus its proper support, especially as the uterus will now be free and will soon regain its normal weight.

I have repeatedly made the observation that in cases in which the uterus has been strongly retroflexed and firmly fixed to the posterior pelvic wall, the round ligaments have become markedly atrophic, mere strings, so to speak, while in cases where the uterus is held backward by a band of some length, allowing some motion, the round ligaments are often greatly hypertrophied. In other words, if the uterus is so firmly adherent that contraction of the muscle fibers of the round ligaments is absolutely futile, the fibers will soon atrophy and stop contracting, but if by contracting they are able to approximate the two ends of the round ligament, they soon regain their tone. Thus in the three cases in which I did a second operation, I found that the round ligaments had regained their normal size and tone and were again performing their duties satisfactorily.

During the years 1906 and 1907 I performed thirty-two laparotomies in which this operation seemed indicated. In all the uterus dropped back into the abraded pelvis after the intraabdominal work was completed. For convenience, I have classified them under eight headings, according to the most prominent pathological finding. Practically all, however, exhibited several pathological lesions, any one of which would have required surgical interference. Thus for instance, several had pelvic abscesses, and at the same time appendicitis.

I placed each one of these only under one heading, choosing that heading in which the lesion was most pronounced.

Thus, there were ten cases of salpingitis, nine pyosalpinx, four ovarian abscess, three multiple pelvic abscesses, two appendical abscess, two simple appendicitis with pelvic adhesions, one multiple fibro-myomata necessitating myomectomies, and one double multilocular ovarian cysts.

I will not give any of these histories further than to say that of these thirty-two, two subsequently returned for secondary operations. Each one of the other thirty has been examined three or more times since the operation, and in every case the uterus has been found movable, in good position, and none of them have been subsequently troubled with chronic constipation, a symptom which is so common following operations for pelvic infection, unless every precaution is taken to prevent adhesions, especially the adhesion of a retroflexed adherent uterus.

On three cases, two operated in the year 1906, and one operated in the year 1905, have I had occasion to do secondary operations and to examine the pelvic organs in each case about fifteen months after the first operation. One case, a large, left ovarian abscess and left pyosalpinx, another a left cystic ovary and double salpingitis, and the third a pelvic abscess and right pyosalpinx and ovaritis, and left salpingitis. These all being young women, I deemed it advisable to preserve the best ovary, which subsequently made trouble and had to be removed. In two of these patients the uterus was found perfectly movable, without adhesions, in normal position, with strong, well-developed round ligaments. In the third case the remaining ovary had become adherent to the sacrum, the uterus was slighly adherent to the sigmoid, was fairly movable, the round ligaments well developed and performing their duties. In none of these cases were there any adhesions either of the omentum or of the uterus to the anterior abdominal wall.

I have been doing this operation for about seven years, but as the first four years I was operating at several hospitals and have not a complete list of all the operations of this kind that I performed, I thought it advisable to confine my report to the cases operated during a definite period, and cases which I have had an opportunity to watch carefully and examine repeatedly. I may, however, add that in no case which I have had an opportunity to examine subsequently have I found the uterus permanently suspended, or adherent posteriorly and acting as a plug to the pelvic outlet, a condition so often observed following operations for pelvic infection.

The operation above described has the following points to recommend it: It has none of the objections attributed to permanent ventrosuspension or fixation; it is extremely simple and consequently easy of application; it does not open up new areas for infection; it does not increase the shock of the operation; it leaves the pelvic organs in as nearly a normal condition as the pathological conditions for which the operation is undertaken permit; and finally, it has the great advantage of apparently being practically always effective.

In conclusion let me say, it would seem reasonable to suppose that many surgeons have made use of this procedure before, but as we were not able to find any record of it in the literature, we deemed it worth while to make this brief report.

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DEPARTMENT OF TECHNIQUE

WHY OPERATIONS FOR BUNION FAIL, WITH A DESCRIPTION OF ONE THAT DOES NOT

By JOHN L. PORTER, M. D., Chicago

Many operations undertaken for the relief of bunion are unsatisfactory and disappointing, at least so far as the patient is concerned. Why?

Because they fail to completely correct the deformity, or else they leave a stiff joint, or both. The reasons for these imperfect results may be any one or more of five; viz.:

1. Failure to remove enough bone from the metatarsal head.
2. Removal of bone from both of the joint surfaces.
3. Failure to remove all the obstacles to correction of the deformity.
4. Failure to maintain correction for sufficient time after the operation.
5. Failure to see that the patient is properly shod after recovery from operation.

The most common and most potent reasons for failure are the first two.

If insufficient bone is removed the deformity cannot be corrected although all the other precautions are observed. If the bone is removed from both metatarsal and phalangeal surfaces a stiff joint will surely result.

The most potent obstacle to reduction of deformity that is most frequently overlooked is the shortened tendon of the extensor proprius hallucis.

Fig. 1. Line of incision.

Fig. 2. Shows bone removed and suture applied.

With the idea of trying to avoid all these causes of failure, I devised the following technic, and have followed it exactly in every case, I do not know how many, during the past five years, without having one dissatisfied patient.

The foot is elevated and a constrictor put around the ankle. The operation can be done much more rapidly if the field is not filled with blood. A crescent-shaped incision two inches long is made just below the edge of the callus which covers the enlarged head of the metatarsus. I found after several experiments that this incision gave freer access to the joint at exactly the spot the bone is to be removed than any other, and the resulting scar, if any, is just between the points where the upper and sole of the shoe make pressure.

The capsule is incised in the same direction and to the same extent as the skin incision and the capsule and periosteum are pushed away from the bone a little at the point where they meet.

With a pair of narrow, long-jawed bone scissors

about three-quarters of the articular surface of the head of the metatarsus is removed, at such an angle as to include all of the enlarged inner tuberosity.

I do not remove all of the head of the bone, for three reasons:

1. It is not necessary. The deformity can be perfectly corrected without.

2. It does not shorten inner border of the foot and thus make it look unnatural.

3. Motion will be more free if some of the articular surface is left.

After the bone has been removed the toe is pulled strongly inward, and the tendon of the extensor proprius hallucis, which is thus brought up into prominence, is divided subcutaneusly at the level of the joint.

Then it will be found that the toe can, with very little pressure, be made straight.

Here a small gauze sponge wrung out of hot antiseptic solution is crowded into the cavity and the constrictor removed. While the toe is held in its corrected position a mattress suture of strong iodine catgut is carried from the lower angle up to the upper angle, returned through the upper angle and brought out at the lower angle. The gauze packing is removed and the suture tied, thus approximating the upper and lower angles of the capsule incision, and if the bone has been properly removed and the tendon divided, when that suture is tied the toe will remain straight.

The skin wound is then closed with horse hair or catgut, and a thin gauze dressing put on.

Over the dressing I put a piece of piano felt with a hole in it, like a bunion plaster, and a cigar box splint a trifle longer than the foot and a trifle wider than the toe is fastened to the inner border of the foot with adhesive plaster.

The splint is then covered with a bandage starting at the ankle, the splint being fastened firmly to the foot and the toe fastened firmly to the splint.

If the patient is going out from my observation, I cover the whole dressing with a narrow plaster of paris bandage. Unless there is some indication for doing so I do not disturb the dressing for two or three weeks, but I allow the patient to step upon the foot as soon as he can comfortably. When the dressing is removed I put on a lighter one, still keeping the toe fastened to a splint.

It is not safe to remove all restraint from the toe for at least six weeks.

Now about shoes. The patient must never again be allowed to wear taper-toed shoes, but a straight-lasted shoe, with a broad ball, must be insisted upon even with women in the height of fashion. Otherwise the fibrous tissue with which the injured joint has been repaired will stretch and the deformity recur. If you cannot dictate the shoes, don't do the operation.

A CASE OF MULTIPLE PEPTIC ULCERS OF THE STOMACH FOLLOWED BY PERFORATION. AUTOPSY

By J. H. HEWITT, Ex-Resident Pathologist
St. Vincent's Charity Hospital, Cleveland, Ohio

All authors that I have consulted (Welche, Ewald, Brinton, Hemmeter) are agreed that, in cases of round, peptic ulcer of the stomach, one ulcer is the rule, in the majority of cases, and that cases with three or more ulcers are rare. Brinton in a total of 463 cases found 57 cases with two ulcers, 16 with three, 3 cases with four, 2 cases with five, and 4 cases with more than five. According to his data multiple ulcers are found in about 20% of the cases. It is further agreed that it is not so rare to find, in association with existing recent ulcers, healed scars of former ulcers, and furthermore, many of the cases of exceedingly large ulcers have originated from the coalescence of several single ulcers.

Berthold (1) has reported a case in which 34 ulcers were found in the same stomach, and it is expressly stated that these were not hæmorrhagic erosions, but deep corrosive ulcers.

Lange (2) years ago cited a case in which besides a perforation there were not only an immense number of scars of various sizes and depth all over the walls of the stomach, but also such a quantity of uncicatrized ulcers, some existing only in the mucosa, others penetrating into the muscularis, some flat, some in the shape of holes, others funnel like, that he had to give up the attempt to count them all.

The case here reported is one very much of the same nature. The case is as follows:

[1] From the Pathological Laboratory of Charity Hospital, Cleveland, Ohio

Fig. 1. Reduced to one-fourth size, sites of ulcers indicated by tags.

M. C. First admitted to St. Vincent's Charity Hospital May 14, 1906. Male, 42 years of age, single, American, a farmer by occupation. Remained in the hospital three days and went home of his own accord.

Diagnosis. Carcinoma of the stomach.

Complaint. Pain in the stomach after eating.

Family History. Father died at 71 of "stomach trouble." Mother died at 72, "stomach trouble." Four brothers and five sisters are living and well. One sister died of pneumonia and another of brain fever.

Personal History. Had mumps and measles when a child. Had epileptic attacks when about 15 years of age. They occurred at intervals of about one month. Has not had an attack for 20 years.

Present Illness. Began about 18 years ago. At that time he had severe pains in his stomach of such intensity that at times they would draw him double. He vomited frequently after meals, after which he was relieved of his pain. He does not know whether he ever vomited blood or not. At intervals he was able to eat well and had no pain. Has gradually lost in weight. His ordinary weight is 155 lbs. At present he weighs 115 lbs. He now has intense pain after eating and at times is in great distress on account of distension of the stomach.

Physical Examination. Patient is well developed, but poorly nourished. Skin is dry, not jaundiced. There is no cyanosis, no glandular enlargement. Pupils react to light and accommodation. Teeth in good condition. Heart and lungs negative. Pulse rhythmic and regular, fairly easily compressible, rate 84 to the minute.

Abdomen not distended. Liver not displaced nor enlarged. Spleen not palpable. Right kidney palpable. Tenderness extends from the sternum to the umbilicus, radiating to the left as far as the continuation of the anterior axillary line. Active peristalsis can be seen over the stomach after test meal.

ANALYSIS OF STOMACH CONTENTS

Ewald test breakfast after one hour.
375 c. c. — 3 layers.
Free HCl, 42.
Total acidity, 64.

Admitted again Jan. 2, 1907.

At this time he was suffering great pain and was not able to take solid food. He had lived through the summer chiefly on buttermilk and gruels.

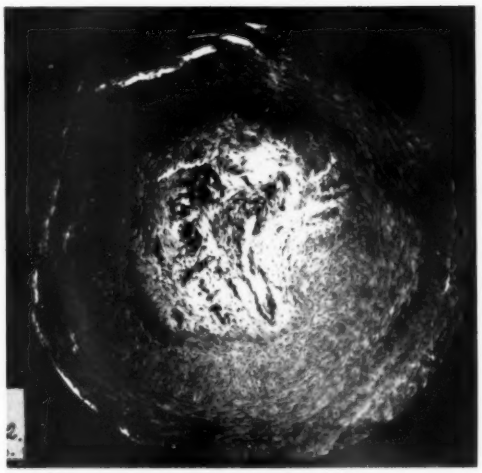


Fig. 2. ·80.

He was operated January 7, 1907, by Dr. Carl A. Hamann.

Operation. A medium incision above the umbilicus about 4 inches in length. A small hard nodule was found at the pylorus. The duodeno-jejunal juncture was found, drawn up through the omentum and approximated to the posterior wall of the stomach. A small part of the wall of the stomach was caught between long clamps, likewise a part of the wall of the jejunum. A continuous Lembert suture was inserted. Then the stomach and intestine were opened with parallel incisions, about 3 inches in length. The mucous membrane was cut off and then a

Fig. 3. ·80.

continuous overlapping suture was inserted. After the ends were reinforced and the slight hæmorrhage stopped by reinforcing sutures, the anterior edges of the mucous surfaces were sewed together so that the mucous membrane was inverted. The serous layers were tightly stitched and reinforced. The opening in the mesocolon was closed with two or three sutures.

Patient left the operating room in good condition.

On the fourth day after operation he went into collapse, vomited, and had symptoms of general peritonitis and died on the sixth day.

Autopsy No. 175.

Died Jan. 13, 1907, 1:20 a. m. Autopsy 12 hours later.

Anatomical Diagnosis. Multiple round ulcers of the stomach; perforating ulcer of the stomach; scar of healed ulcer of pylorus; general fibrino-purulent peritonitis; acute congestion of spleen; parenchymatous degeneration of heart muscle, liver, and kidney.

Body of a middle-aged white male, 168 cm. in length, fairly well developed, somewhat emaciated, quite pale, and anæmic.

Abdominal Cavity. The abdomen is distended and full. On opening the cavity 1,700 c. c. of dirty, greasy fluid, containing particles of partly digested food, is found filling the pelvic and general peritoneal cavity and everywhere covering the intestines and omentum. The appendix is free. The spleen is bound to the stomach wall and diaphragm by recent fibrinous adhesions. The serous surfaces are everywhere covered with a tenacious, stringy, black-colored exudate. Beneath this exudate the surface is seen to be of a reddish pink color, the blood vessels are injected, and there are numerous ecchymoses.

Stomach. The stomach is contracted up under the diaphragm. When drawn down its serous surface is seen to present the same general appearance as that of the general peritoneal cavity. On the posterior surface, 1.5 cm. from the greater curvature and 10 cm. from the pyloric valve, is seen a loop of gut firmly attached to the stomach wall, where a gastro-jejunostomy has been recently performed. The apposed gastric and jejunal wall are held together by silk stitches which are everywhere intact, and there is no appearance of any break or of any leak at any point. On the same surface, 2.5 cm. from the greater curvature and 10 cm. from the cardiac opening, there is a round, punched-out hole in the stomach wall, 5 cm. in diameter. Through this hole black, greasy fluid, of the same nature as that found in the general peritoneal cavity, may be forced out of the stomach by pressure. On opening the stomach along the lesser curvature the mucosa is seen to be of a general reddish color and shows numerous ecchymoses. The pyloric orifice is firmly contracted and admits a match with difficulty.

Along the lesser curvature, about midway between the cardiac and pyloric orifices, is an oval ulcer of the stomach, about 2 x 2.5 cm. in diameter. Its margins are well defined, but in places slightly undermined, so that the mucous membrane rests on the floor of the ulcer. Along the upper margin there is considerable cicatrix formation. The lower margin appears fresher, as if the process is still actively going on. The floor of the ulcer is clean and fairly smooth, slightly eccentrically crateriform. Near the lower margin of the ulcer there is a projection from the floor of a fairly large thrombosed blood vessel. 3.5 cm. from the pylorus and 1.5 cm. below the lesser curvature there is another prominent, lozenge-shaped ulcer, measuring 1.5 x .75 cm. It is more superficial and shallower than the former and is of comparatively recent origin. On the posterior surface and along the greater curvature may be seen numerous small, round punched-out ulcers, varying in size from the head of a pin to .5 cm. in diameter. Some of these ulcers

Fig. 4. ×80.

are filled with recent blood clot, but, for the most part, they present well-defined, sharp-cut margins, and a smooth floor. Each separate and distinct ulcer that could be made out as such was tagged and numbered, as shown in Fig. 1, to be sure that none should be counted twice, and, including the old cicatrized ulcer near the pylorus, SIXTY (!) ULCERS were noted. There are several small depressions in the mucosa, as of beginning ulcers, but only those that definitely extend through the mucosa are taken into account. On opening the pylorus there is found a firm and contracted cicatrix of an old ulcer.

Spleen. It is soft in consistency, small in size. The capsule is of a grayish purple color, somewhat thickened, covered with a recent fibrino-purulent exudate, and quite shriveled in appearance. The pulp is quite soft and bulging, of a dark red color. The trabeculæ and Malpighian bodies stand out plainly. Weight, 100 grams.

Liver. It is about normal in size, very pale in color, and soft in consistency. The capsule is thin and strips readily, leaving a smooth surface. Cut section shows the liver substance to be quite soft and friable, of a light yellowish color. It weighs 1,600 grams.

Gall-bladder is distended with dark bile. No stones. The bile ducts are patent.

Pancreas. Somewhat swollen and soft in consistency; otherwise, apparently, normal.

Kidneys. Left kidney is somewhat contracted, of a grayish red color, and of fairly firm consistency. The capsule is thickened and strips with some difficulty, leaving a torn, irregularly roughened surface. On section the cortex is seen to be thinned out and of a whitish color, the spaces between the pyramids are increased in width, pale in color, and firm in consistency. The glomeruli are not well made out. Weight, 90 grams.

Right Kidney. It has, practically, the same appearance as the left. Weight, 100 grams.

Adrenals. They appear slightly swollen and soft. On section the medulla is of a dark brownish color, very soft, and almost fluid.

Urinary Bladder. Its mucosa is smooth and glistening.

Prostate. It is enlarged, quite firm, and fibrous.

Intestines. Their mucosa shows no ulcers and is everywhere, apparently, normal.

Thorax. There is no free fluid. The pleural surfaces are everywhere smooth and free. The heart is slightly enlarged to the right.

Lungs. They are everywhere crepitant. The cut surface yields a bloody frothy fluid, especially profuse on pressure. The bronchi are unobstructed and appear normal. The pulmonary blood vessels contain only postmortem blood clots. Left lung weighs 350 grams; right lung, 400 grams. Peribronchial lymph glands are deeply pigmented and show several firm white scars.

Heart. The visceral pericardium is everywhere smooth and glistening. The subpericardial fat is slightly increased. The right auricle contains only postmortem blood clots. The right auriculo-ventricular valve admits the tips of three fingers. The leaflets are slightly thickened along their inner margins. The pulmonary valve scarcely admits the tips of two fingers, but the cusps are everywhere free, smooth and thin. The left auricular and ventricular cavities contain only postmortem blood clots. The mitral valve admits the tips of two and one half fingers. The leaflets show several patches of thickening and there is some general thickening along their inner margins. The aortic valve admits the tips of two fingers. The cusps are thin, delicate, and smooth. There is some thickening around the orifices of the coronary arteries.

The coronary arteries show several patches of thickening around the orifices of their branches. The left ventricular wall measures 1.5 cm. in thickness. The heart muscle is soft and flabby. On section it is of a pale color and shows an occasional white translucent streak. The heart weighs 290 grams.

Aorta. Both the thoracic and the abdominal aorta show several scattered patches of thickening of the intima, and there is a slight general thickening of the vessel wall and some loss in elasticity.

Thyroid. It is slightly enlarged, but on section appears normal.

Microscopical Examination. Stomach. Sections of the large ulcer situated along the lesser curvature near the pylorus show the mucosa around the margin of the ulcer to be quite undermined, by a more extensive degeneration and necrosis of the submucosa and musculature, so that it dips down, in some places gradually, in other places very abruptly, to the floor of the ulcer. The glandular tubules around the margin are diminished in number and the intertubular connective tissue is markedly increased. The submucosa shows a patchy, round cell infiltration and great increase in the connective tissue. The blood vessel walls are thickened. The floor of the ulcer is covered with a thin layer of mucus in which there is a quantity of dark-staining granular material and a few desquamated mucosal cells. Beneath this layer there is a layer of necrosed connective tissue cells. This is definitely a part of the floor of the ulcer and shades off gradually and irregularly into the subjacent connective tissue. At the bottom of this layer there is a small amount of round cell infiltration. The base of the ulcer is made up of dense, irregularly arranged, connective tissue fibers, between which there are scattered patches of round cell infiltration, and blood vessels with markedly thickened walls. The thickening of the arterial wall is of the nature of an obliterative endarteritis. In some cases the vessel has become almost completely obliterated and its lumen canalized by the development of small thin-walled vessels within its lumen, as shown in Fig. 2. A section of the vessel projecting into the floor of the ulcer shows a marked increased thickness of its intima and a well defined occluding, fibrino-hæmorrhagic thrombus, as shown in Fig. 3. Beneath the serosa there

Fig. 5. ×80.

is a moderate amount of fatty infiltration and also marked thickening of the walls of the blood vessels. Both the longitudinal and the circular layers of muscle fibers have been replaced by fibrous connective tissue. Immediately beneath the serous layer there is marked leucocytic and lymphocytic infiltration. The serosa itself is covered with a dense layer of fibrino-purulent exudate.

Sections of the smaller ulcers, especially when they are situated between the folds of the gastric rugæ, show on the surface a layer of old hæmorrhage. The blood cells are broken down and appear as irregular, broken masses of a brownish color, or slightly stained with eosin. However, in some of the small ulcers well preserved and normal red blood cells can be readily seen. Beneath this layer of hæmorrhage or blood clot there is an irregular mass of necrotic tissue having somewhat the resemblance to the gastric mucosa and its submucosa. Scattered through this mass are quite a number of leukocytes and plasma cells with the red blood cells and blood clot. At the margins this necrotic mass is sharply defined from the adjacent tissue of the stomach wall, as shown in Fig. 4. Along the bases of several of these ulcers may be seen blood vessels a portion of whose walls, which are only moderately thickened, rests in the margin of the necrosed area, and are themselves, at this point, necrosed. In the portions of their lumina that are adjacent to this area, they are filled with well defined, fibrino-hæmorrhagic thrombi, as shown in Fig. 4.

At the pylorus the mucosa and submucosa show marked infiltration with connective tissue and small round cells. At one point there is a definite scar of an old healed ulcer. Both layers of the muscle fibers are slightly hypertrophied. Over other regions of the stomach the circular muscle layer appears markedly hypertrophied, except below the base of the old cicatrized ulcer, near the pylorus. The longitudinal muscle layer is atrophied to a great extent and its fibers replaced by connective tissue cells.

At the point of rupture the circular muscle fibers appear to have undergone a more extensive necrosis than the longitudinal layer and serosa or mucosa, so that the mucosa and serosa appear to approach one another, as shown in Fig. 5. There is some round cell infiltration along the margin of the ruptured ulcer.

The mucosa over the fundic region shows a marked increase in the number of oxyntic cells and the lymphoid tissue is everywhere well developed.

Spleen. The capsule is covered with a layer of fibrinopurulent exudate. The trabeculæ are large and fibrous. The Malpighian bodies are small; their central arteries show hyaline degeneration. The pulp is deeply congested and shows a slight increase in the connective tissue.

Liver. There is slightly marked chronic passive congestion, the liver cells are compressed, small, and degenerated about the center of the lobules.

Kidney. The capsule is thickened and fibrous. In places there are bands of connective tissue with more or less round cell infiltration extending from the capsule into the kidney substance. The glomeruli show an increase in the intercapillary connective tissue, some exist as small fibrous nodules. The cells of the convoluted tubules are swollen and quite cloudy. The intertubular connective tissue is increased. The blood vessel walls are thickened and they are deeply congested. There are hyaline casts in some of the conducting tubules.

Adrenal. There is a fairly marked fatty degeneration of the cells of the cortex and some pigmentation of the cells of the medulla.

Prostate. It shows an increase in the intertubular connective tissue.

Pancreas. There is slight increase in the interacinar connective tissue and marked increase in the interlobular connective tissue, particularly marked about the ducts. The acinar cells show cloudy swelling. Scattered through the section are a few scattered areas of necrosis of the acinar cells with slight infiltration with leukocytes. The blood vessels are deeply congested.

Thyroid. The acini are small, contain colloid, and are lined with low cuboidal cells. The interlobular connective tissue is increased. The blood vessels are deeply congested and the walls slightly thickened.

Heart. The muscle cells show moderate hypertrophy and the interfibrillar connective tissue is slightly increased.

Lungs. The alveoli are slightly distended and filled with serum, a few red blood cells, and leukocytes.

The main point of interest in this case is the number of well defined round, peptic ulcers, existing in all stages from the old healed scar to the acute perforation, as shown by macroscopic and microscopic examination. Besides the case reported by Lange (2), I am not aware of a similar case in the literature.

I am indebted to Dr. C. A. Hamann, in whose service at the Charity Hospital this case occurred, for the suggestion and privilege of making this report. For this and many other favors rendered me during my service at the hospital, I wish to express to him my sincere thanks.

AN EFFECTIVE DRESSING FOR THIGH AMPUTATIONS

By WELLER VAN HOOK, A. B., M. D.

A very simple and effective way of dressing thigh amputations is shown in the accompanying illustrations which are taken from a case in which long-standing suppuration due to tuberculosis of the knee-joint had injured the limb to such an extent as to necessitate its removal.

It will be seen that two sterilized adhesive straps about two inches wide and eighteen inches long had been applied to the bare leg, after the sutures had been inserted. To the ends of these adhesive straps

Fig. 1. Showing attachments of adhesive.

Fig. 2. Strips tied, holding dressings in place.

bandage muslin was applied by means of safety pins to form two straps that could be tied together over the end of the stump, which previously had been dressed with a considerable amount of gauze and cotton. This made it possible at once to make equable pressure upon the end of the stump, to provide for discharges, and to relieve the great tension which otherwise is almost sure to occur about an amputation stump. When this had been applied a cast was put over the stump and firmly about the thigh, pelvis, and lower abdomen. A fairly large dressing had been placed over the first dressing and the tied bandage ends.

At the first dressing the end of the cast was removed from over the wound, exposing the dressings. These were easily replaced and the straps tied together again. No plaster was put over the end of the stump, a roll of bandage muslin sufficing to retain the dressing in place. It was possible at each subsequent dressing to replace the bandages, if soiled, with fresh pieces of muslin so that everything was easily kept in order. The cast prevented movement at the hip-joint and added greatly to the patient's comfort.

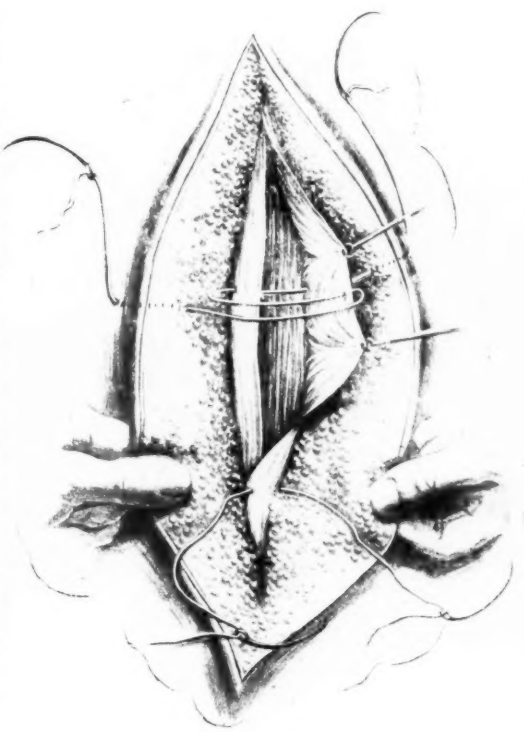
The method of dressing is very simple and effective and can be applied to any amputation. Dr. Beach, of Wesley Hospital, kindly carried out the details of treatment.

A COAPTATION AND IMBRICATING SUTURE FOR CLOSING THE ABDOMINAL INCISION

By D. TOD GILLIAM, M. D., Columbus, Ohio

The present method of closing the abdominal incision with imbrication of the aponeurosis is by three sets of sutures — two of which are buried. These buried sutures are usually of twenty-day catgut or some other absorbable material and not infrequently give rise to irritation of the tissues in which they are imbedded, with a resultant serous discharge and gaping of the wound. To obviate this, I devised a suture which could be removed at the proper time — a single suture which takes the place of three and which requires but little more time to place than either of the three which it substitutes.

Technique. The method in brief is as follows: After closing the peritoneum clear the face of the fascia on either side of the incision to the width of three-quarters of an inch or more. Now, as the fascia is to be lifted from the muscle on the left side, the under surface of which is to be applied to the upper surface of the fascia on the right side, it follows that these surfaces should be laid bare and clean. Less careful dissection is necessary of the upper surface of the fascia on the left side, for here the principal object is to mobilize the fascia so that it can be drawn over and superimposed to the fascia on the right side. The fascia on the left side is separated from the muscle to the width of half an inch, that on the right side being undisturbed. This makes one aponeurotic flap, that on the left side. All these dissections of the fascia are greatly facilitated and indeed made easy by steadying the fascia with volsella. In cleaning the upper surface the skin and fat should be re-



A coaptation and imbricating suture for closing the abdominal incision.

tracted and the face of the fascia laid bare with the knife. The separation of the muscle from the fascia is best accomplished by blunt dissection, or by pushing the muscle off with the gauze covered finger. As a suture material I prefer the silkworm gut, both because it is less irritating and because it is less elastic, holding the aponeurotic surfaces in closer apposition. The sutures are threaded at both ends and the needles are passed from within outward through the skin, and no needle is used a second time after having penetrated the skin. By this means skin germ infection is obviated and the sutures may be left *in situ* ten, fifteen, and sometimes twenty days without suppuration. Ten days, however, is usually sufficient and if left longer they should be watched closely and removed on the first indication of trouble.

Placing the Suture. Beginning on the left side, pass th eneedle through the attached border of the aponeurotic flap from without inward, then by a Lembert stitch through the aponeurosis on the right side, then through the free border of the aponeurotic flap from right to left, and finally up through the skin on the right side. The distal needle is now passed from within outward through the skin on the left side at a point opposite that from which the first needle emerged.

Other sutures are placed in like manner at intervals of three-fourths of an inch. As each suture is being tied it is sawed back and forth not only to see whether it will run and therefore present no difficulty in removal, but to bring the aponeurotic surfaces into apposition.

The advantages of this method are its simplicity, the rapidity with which the wound can be closed, and the absence of buried suture material and especially the knots which often create havoc with the most carefully executed work of the surgeon. Chromicized catgut or any other suture material may be substituted for the silkworm gut if thought desirable, with much less chance of irritation than when the knots are buried. In using the absorbable suture material a little firmer apposition of the aponeurotic surfaces can be obtained by passing the needle through the free border of the aponeurotic flap from without inward. This cannot be done however when the suture has to be removed, as it locks it in the tissues. In actual practice the suture is quickly placed and is much less complicated than would appear from the description.

GASTRIC ACCRETION[1]

Report of a Case with Gastrotomy

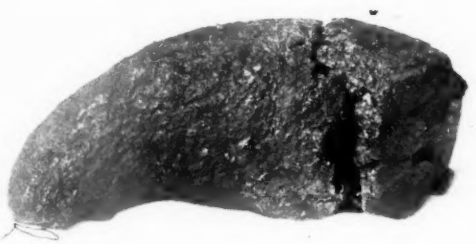
ARTHUR M. SMITH, Cherokee, Kansas

Patient. Mr. H. C. M., American, aged 45, height 5 feet, 5½ inches, weight 155 lbs. Occupation, farming, and shot-firing.

Family History. Negative, excepting maternal grandfather's death was due to cancer of the stomach, secondary to external malignancy, for which he underwent an operation.

Personal History. Tetanus at the age of 20, (6 weeks duration), resulting from laceration of finger. About seven years ago was compelled to give up occupation of mining, for several weeks, owing to tacycardia, and gastric distress, which the gases of the mine aggravated. Later returned to the mines and worked without inconvenience. For ten years or more eructations have occurred daily. Two years ago sustained quite severe burns of face, neck, shoulders, and hands, the result of gas explosion. Never drank alcoholics. No specific history. November 15, 1907, while driving, came to a persimmon grove, and ate, as he thought, about a double handful of the persimmons.

Subjective Symptoms. November 15, 1907, three hours after eating persimmons, while in mine working, was taken with quite severe distress in pit of stomach. Was nauseated, but could not vomit, not withstanding several attempts to do so. This distress continued without intermission for several days. Consulted physician on the 17th, owing to discomfort in stomach, and unusual constipation. Usual cathartics failed to relieve symp-



The greatest length was 17½ cm., greatest diameter 7½ cm., weight 416 gms. The ulcer on the stomach was located on the wall opposite the end marked at the lower left-hand corner.

[1] Read before the Frisco System Medical Association, Kansas City, Mo., May 26, 1908.

toms. Bowel action resulted on the 18th from enema. Constipation continued obstinate until about December 20th. Slight headache daily, some dizziness, sick stomach frequently, no vomiting, indifferent appetite, lack of usual energy, wakefulness increasing, belching constant, heaviness or load in stomach. Taking food or water modified stomach symptoms for an hour or two.

Objective Symptoms. (Taken December 10, 1907, twenty-five days after beginning of present illness.) Facial apathy, lassitude, anæmia, skin of face and extremities slightly cyanotic, pernicious eructations. Lung negative, hear sounds normal, but so faint as to be barely audible, rate 54 per minute. Temperature normal. Nothing abnormal on palpation or percussion in right half of abdomen. In left epigastrium could be palpated a mass, which slightly impaired resonance, pressure over mass caused nausea, deep inspiration increased its prominence. Could displace tumor slightly upward and outward, also downward and outward, in the arc of a circle. Introducing 1,500 cc. of water into stomach rendered the tumor less prominent. Remainder of abdomen negative and normal in contour.

Laboratory Findings. Urine analysis negative. Two specimens of gastric contents taken: 1. One hour after test meal; 2. Six hours after ordinary meal. Dr. O. B. Kiehl, to whom they were submitted made the following report:

"1. Free Hcl 35. Total acidity 50. Lactic acid negative. Contains much mucus, undigested starch, many bacteria, few Boas Oppler bacilli, no blood, pus, or epithelium.

"2. Free Hcl 15, total acidity 35."

Diagnosis. History of ingesting persimmons, short time before present trouble began, which were frosted but not frozen, food or fluid in quantity relieving or modifying distress for short time, and findings in gastric analysis, led us to believe that patient was suffering from foreign body, result of food eaten, if this were possible, and an early operation was advised, which was declined.

Treatment. Strychnin and berberin given each three hours, phos. sod. 2½ hours after meals, lavage was frequently done, with massage. This, with restricted diet, constituted treatment.

Additional Subjective Symptoms. December 28, 1907, (43 days after beginning of illness) patient for the first time suffered pain in epigastrium, radiating to back, left scapula and clavicle. This pain rapidly increased in severity.

December 30th, two days after pain in stomach was manifest, patient consented to an operation and went to the Mount Carmel Hospital, Pittsburg, Kansas, January 1, 1908, for usual preliminary preparation.

Operation. January, 2, 1908, (48 days after beginning of illness) one hour before patient was taken to operating room, stomach was thoroughly washed, and one fourth grain of morphine given hypodermically.

At 11:40 A. M., under ether, with the assistance of Doctors A. D. Hays, Chas. Chapin and O. B. Kiehl, an incision was made over the most prominent part of the tumor, extending from costal margin downward about 9 c. just to the right of the left semilunaris. Left rectus was split and on opening peritoneum, anterior gastric wall protruded, stomach being greatly distended with gas. On palpating, a tumor could be felt that appeared to be back of the posterior stomach wall, but on passing the hand posterior to the omentum and transverse colon, the tumor was grasped by its small extremity. It was so firmly held by its other extremity, that the force applied in dislodging it broke it through its greatest diameter. After freeing mass, it, together with anterior stomach wall, was delivered through incision. Protecting peritoneum with warm saline pads, gastrotomy incision was made at the right angle to the long axis of stomach, about 6 c. from pylorus. Accretion was delivered, and on exploring the interior of the stomach, an ulcer was found, circular in outline and about 3 c. in diameter, which extended from the upper angle of incision to the lesser curvature. The center of the ulcer was eroded to the peritoneal covering. After completing exploration and removing all fragments of accretion, incision was closed, using the continuous catgut suture as applied by Dr. Charles Mayo. This was reinforced with interrupted Lembert suture of fine linen. Ulcer being at the upper angle of incision, it was included in the suturing and inverted. Abdominal incision was closed in layers, with catgut, without drain. Patient was returned to bed at 1:30, with no manifestations of shock. Pulse 80, with increased volume. Vomited twice in first ten hours, with slight show of blood. Again in fourteen hours with no blood, after which there was no vomiting. Opiate given occasionally during the first seven days. One pint of saline solution each four hours by rectum for 24 hours. Gave weak tea and water, warm, by the stomach during second, third, and fourth days. Buttermilk given on the fifth day. Returned to limited solid diet on the tenth day. Kidneys acted voluntarily. Gas relieved by rectal tube. Bowels moved on the tenth day. Sat up in chair on the eleventh day. Discharged from hospital, January 17th, at 2 P. M. (fifteen days after operation).

Accretion at the time of removal measured 17½ c. at greatest length, 7½ c. at greatest diameter; weighed 416 gm.

UTERUS DUPLEX SEPARATUS CUM VAGINA SEPARATA

By ARTHUR R. CUNNINGHAM, M. D., Spokane, Washington

In the uterus didelphys we have such a rare condition that I feel justified in reporting the following case:

Was called to attend Mrs. H., æt. 20 years, for excessive flowing. Upon examination found a three months' fœtus hanging from the cervix. This was removed by the fingers, after which the instruments were sterilized in order to remove the secundines. Upon making a second examination I was surprised to find a small firm cervix with a closed os. This puzzling condition soon proved itself to be a case of two uteri with double vagina. One uterus had been impregnated and delivered itself of a three months' fœtus while the other uterus of normal size and dimensions had been functionating normally at the regular monthly period; at any rate she had menstruated normally and for this reason had not thought herself pregnant.

Examination made after involution was completed showed the following condition. External genitalia

normal; vagina was divided by a thick vertical septum extending to the introitus. Each vagina thus produced led to a normal-appearing cervix and uterus, which uteri were situated transversely within the pelvic cavity. The two uteri seemed to be entirely independent of each other, unless possibly there was a very small attachment nea the cervices, which could not be determined; but as the finger could be pressed in deeply between the two uteri, I am of the opinion that they were entirely separated. The adnexia could not be satisfactorily palpated.

SIMPLE ISOLATED DISLOCATION OF THE CARPAL SCAPHOID

A Study of a Rare Luxation

By HARVEY B. STONE, M. D.
Adjunct Professor of Surgery, The University of Virginia, Charlottesville, Virginia

The purpose of this paper is to report the case mentioned in the title, and to review briefly the literature upon the subject. Dislocations of any sort at the wrist are unusual, but backward and forward dislocations of the entire wrist upon the forearm can hardly be called rare. Dislocations of individual bones, however, are much less commonly met with. The literature upon the subject is rather limited. Tilmann (1–2), Potel (3), Hessert (4), Codman and Chase (13), and Eigenbrodt (5) have contributed monographs upon the general question of isolated luxations of the bones of the wrist, and a number of writers have reported one or more cases. In this mass of material, which has been thoroughly reviewed by Hessert, (*l.c.*) there are fifty-four cases in all of dislocation of the individual bones, exclusive of the os magnum. In most cases several bones are involved, the dislocation is compound, or is associated with fracture. The semilunar suffers more frequently than the other bones. The scaphoid, in a number of cases, has been involved with the semilunar, but the cases of dislocation of the scaphoid alone number only seven, excluding the case here reported. Of these one was compounded, Fag (6), and three of the others were associated with various fractures. Thus Cooper (7) reports a case of dislocation of the scaphoid with fracture of the lower end of the radius; Auvray (8) records a fracture of the scaphoid with dislocation of one of the fragments; and Lembke (9) describes an extensive comminution of the carpal bones with dislocation of the scaphoid.

This leaves only three cases of simple dislocation without other injury. One of these cases, reported by Weber (10) has not been accessible. The other two, briefly summarized, are as follows:

Smith (11), case of adult male who fell a considerable distance over an irregular pile of rocks. Injury of 17 years duration when seen by physician. There was a bony mass palpable over the scaphoid region, and from its shape it was diagnosed as that bone displaced backward. The styloid of the radius was prominent and intact. Reduction was effected by manipulation. Improvement in function noted.

Stewart (12) case of adult male, thrown from buggy and falling upon left hand. There was a tumor over scaphoid which, when seen immediately after accident, was in large part due to œdema. When seen the next morning the œdema had greatly subsided and the scaphoid was recognized in a position of backward luxation. Reduced immediately by manipulation. The results were described as good.

This brings us to the narration of our case, which occurred in the service of Dr. Watts here.

The patient was a colored boy, 16 years old, of good antecedents and past history. He was first seen at the University Dispensary, seeking treatment for a lump on the back of his right wrist, and stiffness and weakness of the hand. The trouble had resulted from a runaway accident two months before, in which the patient had jumped from the vehicle and fallen upon his right hand, which was immediately run over by the wheel of the buggy. Whether the fall upon the hand or the pressure of the wheel caused the injury it was impossible for the patient to say. On examination, a bony tumor of smooth curved outline was felt just over the scaphoid region. The styloids of the radius and ulna preserved their normal relations, and there was no evidence of fracture of the radius, although there was a silver fork deformity. There was tendon crepitus, and all the motions of the wrist were considerably impaired. The grip was weak, and forced motion beyond narrow limits caused pain.

Efforts at reduction proved unsuccessful and an operation was decided upon. A longitudinal dorsal incision was made, the dislocated scaphoid exposed and removed, and the wound closed. Wound healed without incident, and patient was discharged on the seventh day, with instructions to keep joint flexible by active and passive motion.

The patient has been recently seen, at an inter-

val of nine months after operation, and the results are remarkably good. The grip in the right hand is much stronger — as strong now as that of the left hand. With the exception of extension which is still somewhat limited, the motions of the wrist are practically normal. There is no pain with use. An X-ray picture showed the joint normal except for the absence of the scaphoid bone, and the patient is delighted with the result of his operation.

It will be observed that in each of the cases that are recorded, the trauma was of a peculiar nature, involving the application of forces in an unusual manner. Various explanations of the mechanism which results in dislocating single carpal bones have been given, but none are satisfactory. Thus several writers upon the subject hold the view that powerful flexion or extension at the wrist, accompanied often by the application of direct force to the joint, is necessary to cause the injury. Plausible as this sounds, repeated experiments upon the cadaver have failed to support the theory.

Potel (*l. c.*) from a study of the bony architecture of the carpus and metacarpus, has arrived at an ingenious hypothesis. He conceives of the metacarpal III, with the os magnum, acting as a wedge toward the first row of carpal bones. With the application of violent force to the metacarpal, the first row is disrupted, the most direct action being exerted upon the semilunar and scaphoid. Clever as such an idea is, and well as Potel supports it by convincing-looking sketches, it hardly squares with the facts, since only rarely have carpal bones been dislocated by force so applied, the usual trauma being exerted directly upon the wrist itself, and so variously that it is hard to generalize the laws of its mechanism. Indeed from a consideration of the number of bones and joints in the wrist, the small size of the bones, and the support of powerful ligaments and tendons — all of which factors tend greatly to break up forces, and so prevent dislocations — the rarity of such dislocations is explained, even in view of the great exposure of the wrist to injury. This rarity is so striking, particularly in the especial injury we report — four cases only on record — that the writer does not believe that any classification of forces, or description of a typical mechanism is possible. None of the patients has been able accurately to describe the positions or movements of the wrist; all of them have been subjected to violent forces, variously applied; and it is probably out of the question to try to trace out or reproduce the movements that led to the injury. Some singular combination of forces, rarely occurring, perhaps associated with previous ligamentous weakness or injury, and possibly different in each case, has resulted in this rare luxation. Of course, when neighboring bones are dislocated or broken also, the ease with which the scaphoid may be displaced is greatly increased, and the greater frequency of the dislocation in such circumstances is easily understood.

The diagnosis, especially in recent cases and without the X-ray, may be very difficult. All of the writers upon the subject call attention to the liability of confusion with a Colles' fracture or a sprain. The relative position of the ulnar and radial styloids, which in dislocation is of course unchanged, is an important point in distinguishing from Colles' fracture, as is the fact that there is little or no visible alteration in the palmar aspect of the wrist. With the introduction of the X-ray the assertion was made that many cases now treated as sprains would be recognized as partial dislocations of one or more of the carpal bones, but such cases have not, as yet, been reported.

In both cases found in the literature, reduction by manipulation is described. One of these was a case of seventeen years' standing. Reduction was impossible in our case; and the conclusion reached by reviewing reports of dislocations of the other carpal bones, is that this class of dislocations can usually only be reduced when quite recent. The treatment for cases of long standing is the operative removal of the displaced bone. If untreated, there is considerable disability, weakness, impaired motion, and pain, and operation offers hope of marked improvement.

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JANUARY, 1909

POSITIVE PRESSURE APPARATUS FOR INTRATHORACIC OPERATIONS

It is a great pleasure to have seen the Positive Pressure Apparatus for Intrathoracic Operations devised by Dr. Richter and described in the November number of SURGERY, GYNECOLOGY AND OBSTETRICS. The apparatus is extremely simple and well made, and is capable, with but little attention, of maintaining a positive pressure in the lungs of the experimental animal or patient. It seems altogether probable that the use of this apparatus will be of great service in opening the chest cavity where extensive work must be done upon the intrathoracic structures. The fact that the cost of the apparatus is so small and that it can be carried about with perfect ease, makes it of unusual value.

Thus far work upon the intrathoracic organs and structures has been prosecuted with very great difficulty, on account of the fact that collapse of the lung and corresponding failure of the circulatory apparatus causes the death of the patient. It is to be hoped that surgeons in different parts of the country will at once take up this apparatus, which can be so easily supplied, and experiment with it, at first upon the lower animals, in order that its value may promptly be determined and its place in human surgery decided on.

There are so many diseases of the structures within the chest that could be attacked with advantage, that it seems unfortunate indeed, that an easily portable apparatus for overcoming mechanical difficulties which are to be encountered in this region, has not been devised before. The hope which Dr. Richter's apparatus inspires is one which may easily cause us all to become enthusiastic over the possibility of the opening up of a most difficult field of surgical endeavor.

WELLER VAN HOOK.

ACUTE GENERAL PERITONITIS

Much has been said of late about the curability, operative and non-operative, of acute general peritonitis. There seems to have been and still to be much misunderstanding as to just what acute general peritonitis is supposed to define.

There does appear to be some justification for the assumption that it signifies an acute inflammation of the ENTIRE peritoneum. Granting that this is the correct interpretation phraseologically, is it a justifiable one patholog-

ically? If one considers that the area of the peritoneum is but 2 per cent less than that of the skin, and that its powers of absorption greatly exceed those of the skin, it would appear doubtful if any individual could recover from the intoxication consequent upon any infection virulent enough to produce such a widespread acute inflammation, if indeed anyone could survive long enough for such an extensive lesion of this nature to become established. Autopsy records are of little or no use in this connection, as the cases examined are almost certain to have been complicated by previous surgical intervention, or to have persisted longer than 72 hours, when the tissue proliferation would mark the initiation of the chronic stage. Moreover only a most competent and painstaking examination at autopsy could determine the existence of an acute general peritonitis, an observation utterly impossible through any wound or by any procedure compatible with the modern surgery of this disease.

There is also a great deal of misunderstanding as to what "pus" signifies when found "free" in the peritoneal cavity. At one time the adherents of phagocytosis, who may be said to have some ground for their opinions, teach us that the presence of pus PER SE may be of positive benefit and that the outcome depends greatly upon what the phagocytes are able to accomplish in the war upon the invading microorganisms. Again the information is vouchsafed that pus is verily corruption personified, and if not evacuated by natural or surgical means its absorption is not possible, and by remaining in the belly will lead to death or conditions which are worse.

Facts give the best foundation for surgical methods and, once established, should suffice to discontinue untenable hypotheses based upon impossible pathology. The occurrence of free pus about the site of an intraperitoneal lesion is no more a certain guarantee of a general peritonitis than is the discharge from a ruptured boil, flowing over the skin, an index of a general dermatitis. Not only does pus spontaneously disappear from the peritoneal cavity, but, thanks to experimental work, it is known exactly how this takes place. Widely disseminated irritability of the peritoneum may result from a limited infection and be connected therewith by no definite pathological change, a fact which has been recognized clinically and demonstrated experimentally. This, however, frequently offers at the bedside another apparent though perfectly unreliable evidence of a generalized inflammation, but upon which a diagnosis is frequently based.

American medicine as a whole, and perhaps its surgical branch in particular, is at present attracting some attention throughout the world.

In view of the remarkable results we are now obtaining in peritoneal surgery, we ought to be exceptionally careful in the phraseology of our diagnoses.

Recoveries do occur from diffuse peritonitis, whether operated upon by this method or that, or even when allowed to get well without medical interference or surgical intervention.

Until there is positive proof that acute general peritonitis is a possibility, and then that it is a non-lethal possibility, why not be content with the remarkable progress that is actually being made and rejoice that the advanced cases of diffuse peritonitis are by their decreasing frequency and diminishing mortality-rate giving eloquent testimony to the progress in American diagnosis and therapeutics.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF SURGERY

UNDER THE CHARGE OF

JOHN B. MURPHY, M. D.
FREDERIC A. BESLEY, M. D.
WM. C. DANFORTH, M. D.
AIMÉ PAUL HEINECK, M. D.
E. WYLLYS ANDREWS, M. D.
WM. R. CUBBINS, M. D.
M. G. SEELIG, M. D.
GEO. E. BEILBY, M. D.

Studies in Gastric Surgery. DR. R. STUMPF. From the Karl-Olga Hospital in Stuttgart. Prof. Hofmeister, Chief. *Beiträge zur Magen-Chirurgie, Beiträge zur Klinischen Chirurgie*, Band 59.

I. CARCINOMA

From March, 1903, to October, 1907, 49 cases of carcinoma came under observation, of which 44 were operated.

Age 1. Under 40 years 18 per cent.
2. Between 40–50 years 38 per cent.
3. Between 50–67 years 44 per cent.

Thirty-six patients gave trustworthy statements as to the length of time they had suffered. These grouped according to the age groups above appear as follows:

1. Group 1, 6.3 months.
2. Group 2, 7.6 months.
3. Group 3, 7.9 months.

It therefore appears that the disease progresses more rapidly in the younger individuals than in the elderly.

Six of the operated cases, 66.6 per cent, were men and 33.3 per cent women. The average age of the women was 49.1 years, of the men 47.6 years.

Etiology. In 12 per cent a history of ulcer was present. A traumatic causation was in no case suspected.

Diagnosis. In 89.8 per cent the diagnosis was made previous to operation. In 9.1 per cent a different diagnosis had been made and operation showed carcinoma.

Palpable tumor found in 30 of the 44 cases. Abnormal resistance present in 4 cases.

Vomiting was absent in 20 per cent of cases.

Pain was absent in only 5 cases.

Motor insufficiency present in all but 3 cases.

In 3 cases free was present.

Operation. 44 cases of carcinoma were operated, the forms of technic being as follows:

Resection, 21 = 47.7 per cent.

Gastro-enterostomy, 16 = 36.1 per cent.

Jejunostomy, 6 = 13.6 per cent.

1 = 2.2 per cent. (One segmentary resection for sarcoma.)

Hofmeister makes a resection whenever it is at all possible, making his indications for this form of attack very liberal. His contraindications are:

1. Impossibility of determining the boundaries of the tumor and of rendering it approachable.
2. Inseparable adhesions to liver, pancreas, and colon.
3. Metastases in liver and parietal peritoneum.
4. Extensive glandular metastasis.
5. Unfavorable general condition.

Mortality. Of 45 cases 5 died or 11.1 per cent; causes were as follows:

Peritonitis, 2 = 4.4 per cent.

Pneumonia, 2 = 4.4 per cent.

Hæmorrhage from the stomach following operation, 1 = 2.2 per cent.

Location of the Carcinoma.

Pylorus and Pars Pylorica, 10 cases = 25 per cent.

Smaller curvature, 23 = 57.5 per cent.

Posterior wall, 2 cases = 5 per cent.

Cardia, 0 cases.

Point of origin no longer determinable, 5 cases = 12.5 per cent.

Further conclusions as to location and its relation to symptoms and treatment:

1. The most frequent point of origin is the lesser curvature.

2. Carcinomas beginning at the pylorus cause suffering to the patient rather earlier than those beginning in the lesser curvature.

3. The carcinomas of the pylorus are almost twice as frequently accessible for resection as those beginning in other parts of the stomach.

4. Prognosis is most favorable in carcinomas of the pylorus without adhesions. Those with adhesions and glandular metastases are as unfavorable, prognostically, as those at the lesser curvature.

Of the 45 cases 23 were not resected, other forms of technic being employed. Of these 3 died, a mortality of 13 per cent, that of resection being but 9.5 per cent. Procedures were the following:

Gastro-enterostomy, 16.

Jejunostomy, 6.

Exploratory laparotomy, 1.

Hofmeister favors gastro-enterostomy, and performs in cases where the following conditions exist:

1. Evidence of stenosis.

2. In cases in which stenosis is evidently soon to appear.

3. Stagnation.

The posterior retrocalic operation is preferred, and the suture method is given the preference over any form of mechanical aid.

Jejunostomy was done where no good location for a gastro-enterostomy existed, once for cardiac stenosis, once for hour-glass stenosis, and once for severe pain. None of the 6 cases so operated died. Wetzel's method was employed.

2. BENIGN DISEASES OF THE STOMACH

The writer states in short the indications for operation in this class of cases to be as follows:

1. Open, uncomplicated ulcer, not yielding to medical treatment.

2. Pylorus-stenosis, produced by an open ulcer, a scar, or adhesion or kinking caused by perigastritis.

3. Callous and penetrating ulcer, or ulcer perforating into the free abdominal cavity.

4. Cases where carcinoma is suspected.

5. Small hæmorrhages, dangerous on account of their frequency.

6. Large hæmorrhages. The writer is not so positive as to the value of operation in these cases.

RECAPITULATION

A. Carcinoma. 1. In diagnostically doubtful cases the greatest importance may be placed upon loss of weight. When persistent loss of weight is observed, even when the other symptoms are uncertain, an exploratory laparotomy is to be advised.

2. The indications for resection should be made as wide as possible, as the results of resection even when used as a palliative operation surpass those of gastro-enterostomy, and according to the figures of the writer the danger of the procedure does not seem so great.

3. In cases of slowly growing carcinoma, gastro-enterostomy seems also to give good results. In rapidly growing tumors it as well as jejunostomy may mitigate the pain, although life may not be prolonged.

4. Carcinomata with long periods of pain before operation often give better and more lasting results, than those which come early to operation. The latter are apt to belong to the rapidly growing tumors.

B. Ulcer. 1. In uncomplicated open ulcer, excision of the ulcer and gastro-enterostomy give good and lasting results. These may be done in the same case.

2. In benign stenosis of the pylorus, resection gives good and lasting results. Gastro-enterostomy and plastic work on the pylorus fail in 33 per cent of cases.

3. In cases of perforated ulcus ventriculi and duodeni, operation was made with success in 5 per cent of cases. W. C. DANFORTH.

Clinical and Experimental Study of Renal Exclusion. (Etude clinique et expérimentale de l'exclusion rénale). GAYET ET CAVAILLON, Exposé des titres à l'Argrégation, 1907. *Archives générales de Chirurgie*, April, 1908.

In some cases of renal tuberculosis and in some cases of inoperable neoplasms of the kidney Jaboulay has advised the exclusion of the diseased kidney. The exclusion of the kidney is for the purpose of preventing the inflammation of the bladder by the descending route and in fact in one case we have noted the cure of cystitis after ligating the ureter. Ligation of the ureter determines an atrophy of the corresponding kidney and lessens the virulence of its contained bacilli. In proof of these statements are the cases of renal tuberculosis that have recovered spontaneously after obliteration of the ureter. In cancer, we seek to arrest the renal hæmorrhages by ligation of the ureter. Exclusion of the kidney has limited indications in renal tuberculosis and in neoplastic diseases which do not admit of nephrectomy. By the employment of this procedure in tuberculosis of the kidney we transform an open tuberculosis into a closed focus tuberculosis. It protects the urinary bladder from a descending infection, or if the bladder is already the seat of tuberculous lesions, by protecting it from incessant reinoculations, it favorizes the healing of these vesical tuberculous foci. AIMÉ PAUL HEINECK.

Subtemporal Decompression in a Case of Chronic Nephritis with Uraemia; With Especial Consideration of the Neuroretinal Lesion. *The American Journal of the Medical Sciences*, 1908, vol. 136, No. 4, p. 484. DRS. HARVEY CUSHING AND JAMES BORDLEY, JR.

The patient, on whom this operation was performed, was a female aged 22 years. She presented the usual symptoms of a chronic nephritis with severe cerebral manifestations — headache, nausea, vomiting, periods of mental confusion and dullness and other signs of pressure. The blood pressure was high, its systolic level averaging from 200 to 250 mm., the diastolic level from 170 to 190 mm. There was an intense so-called albuminuric retinitis. In spite of careful medical treatment over a period of three months, her symptoms became much aggravated and definite signs of uræmia appeared. A number of lumbar punctures were made during this period in the hope of relieving some of her severe pressure symptoms. Fluid was always found under great pressure, but its removal seemed to give no subjective or objective evidence of benefit. In view of some experiences in other renal cases in which a notable temporary improvement in the general symptoms, as well as in the condition of the eyes, had occurred after lumbar puncture, and owing to the severity of this case Cushing was led to suggest a decompressive operation. A right subtemporal decompressive craniectomy was therefore performed. It was accomplished in the usual manner. The dura was found exceedingly tense. It was incised. The subdural space contained no free fluid. The arachnoid, on the other hand, was markedly distended with fluid, which escaped after pricking the membrane in a number of non-vascular spaces where it bridged the exposed sulci. The brain itself appeared soggy and wet. The muscle, galea, and scalp were closed without a drain. Following the operation there was considerable improvement in her condition. Her headaches subsided; there was no further nausea and vomiting; her stupor

rapidly disappeared, and mentally she became more active. Repeated ophthalmoscopic examinations showed progressive improvement in the eye condition. There was a decrease in the swelling of both nerves and retinæ, and the blood vessels became more distinct. There was but little permanent decrease in the blood pressure. Patient was discharged from the hospital about six weeks after the operation in better condition than at any time since her admission. Two weeks later she was readmitted in a semi-conscious state with exaggerated signs of increased intracranial tension and died within a few days. The autopsy revealed chronic diffuse nephritis (small granular kidney), cerebral hæmorrhage, cardiac hypertrophy, arteriosclerosis and chronic aortic and mitral endocarditis. The brain was oedematous, the convolutions flattened and in incising the right hemisphere a large clot was found lying lateral to and above the basal nuclei.

From their study and experience in this case the authors draw the following conclusion: In view of the marked improvement after cerebral decompression, this case adds further evidence in support of Traube's hypothesis (favored by Bramwell, Russell and others) that the cerebral symptoms present in the so-called state of uræmia are largely due to pressure from œdema of the cerebral tissue.

It goes to show, furthermore, that the condition of so-called albuminuric neuroretinitis is, in large part at least, a local œdema of mechanical origin.

The case suggests the propriety of permanent decompression in selected instances of renal disease when medical measures or lumbar puncture have failed to relieve existing cerebral (uræmic) symptoms, or when blindness is threatened owing to rapidly advancing degenerative changes of the neuroretinal tissues.

GEORGE E. BEILBY.

Examination of the Influence of Oxygen on Wounds and Infections. *Deut. Zeit. f. Chir., B. 93, p. 182.*

L. Burkhardt made numerous bacteriologic experiments on animals to test the effect of oxygen on wounds and infections. From these experiments he draws the following conclusions: The contact of oxygen with a wound causes a marked vascular injection and brings about an arterial hyperæmia. The wound remains moister and the formation of granulation tissue is hastened. The growth of bacteria in the presence of pure oxygen is very much inhibited, although the bacteria themselves are not killed. The virulence of the bacteria does not seem in any way to be lessened. When the growth of bacteria occurred in an animal rather than in an artificial culture medium, the growth was not inhibited by oxygen. Animals so treated, however, furnished evidence for the conclusion that the virulence of the bacteria seemed to be lessened. When oxygen was brought into contact with the peritoneum a mild inflammatory reaction took place accompanied by hyperleukocytosis, an accumulation of fluid in the peritoneal cavity, and a lessening of the resorbtive activity of the peritoneum. Ozone seemed even better suited than oxygen to counteract infection, particularly when it occurs in the various body cavities.

M. G. SEELIG.

Fixation of the Movable Cæcum in Cases of So-called Chronic Appendicitis. (Fixation des Cæcum Mobile bei Fallen von sog. Chronischer Appendicitis). PROFESSOR WELINS. *Zentralblatt f. Chir.*, No. 37, 1908.

In a considerable number of cases of chronic appendicitis slight pain remains after appendectomy as before. A part of these cases may be due to an error in diagnosis, as for instance, affections of the genital organs in women or neuralgic conditions in the vicinity of the ileohypogastric nerve; with other cases the unsuccessful results are due, not to a failure in diagnosis but to a wrong conception of the cause of the pain in chronic appendicitis.

In the author's opinion the pains in certain cases are caused neither by inflammation of the appendix or its mesentery, but by an abnormality of position in a long, movable cæcum. This occurs in two different ways. In one, the cæcum may cause this disturbance where there is a relatively too short mesenteriolum.

If one resects the appendix and separates the mesentery, a cessation of the pain results. If the mesentery is long, and exerts a painful traction upon the cæcum from a retroperitoneal position, nothing is gained by a removal of the appendix. Here, only a fixation of the cæcum can be of benefit. It is evident that a relatively short mesenteriolum is of great importance for the occurrence of inflammation, because of the retention of secretions and because of the slowing of the circulation in the appendix wall and mesenteriolum. Many cases of kinking of the appendix after inflammation result from the traction upon the damaged wall, which in healing causes adhesions in a kinked position. In many cases the thickening may be caused through inflammation alone, but it is certainly more often due to the position of the appendix caused by traction of the mesenteriolum. The author has collected 40 cases with the symptoms of chronic appendicitis in which operation showed no evidence of inflammation or other abnormal change, but the cæcum and appendix were freely movable and could easily be drawn through the abdominal wound. Cæcumfixation has caused a cessation of pain in cases in which appendectomy was not successful.

FREDERICK G. DYAS.

The Surgical Treatment of Sciatica. *Deut. Med. Woch.*, No. 29, 1908.

Pers advises operative treatment for sciatica in those cases where all other methods of treatment have failed. He believes that in quite a large number of cases the pain is due to adhesions, consequent upon a perineuritis or due to a perineuritis itself. In this type of disease the pain can only be gotten rid of by stretching or dividing the adhesions, and in order to accomplish this, Pers exposes the sciatic nerve as far up as the sciatic foramen and divides all the adhesion encountered. He reports excellent results and states as a particular advantage of the method, the fact that the results are permanent. In 49 operations, there was 4.8 per cent of recurrence, but he states that, in each instance, recurrence was due to the faulty division of adhesions.

M. G. SEELIG.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF GYNECOLOGY

UNDER THE CHARGE OF

J. Clarence Webster, M. D.
J. C. Hollister, M. D.
Gerry R. Holden, M. D.
E. C. Dudley, M. D.
F. W. Lynch, M. D.
Carey Culbertson, M. D.

A True Case of Implantation Carcinoma. (Ueber einen sicheren Fall von Implantations karzinom.) Rudolf Hans Laufer. *Prag. med. Wchnschr.*, 1908, xxxiii, 571.

On May 5, 1904, an epithelioma of the left side of the tongue was extirpated. On the 13th of October the patient was again seen. There was a tumor of the left cheek which an extirpation proved to be an epithelioma. Adjacent lymph glands not affected. Laufer regards this as a true case of implantation carcinoma because of the absence of all involvement of the lymphatic apparatus and the impossibility of a blood transplantation. He explains the second appearance of the tumor as due to the implantation of the cells of the primary growth in a wound of the cheek during the first operation. C. G. Grulee.

Extrauterine Pregnancy at Term with a Living Child. Laparotomy; Recovery. (Grossesse extrautérine à terme avec enfant vivant. Laparotomie, guérison.) Potocki. *Bulletin méd.*, 1908.

The recurrence in some patients of an extrauterine pregnancy is not exceptional. Numerous observations prove this. It may be observed in the following order of frequency: (*a*) In the tube which in the first pregnancy was uninvolved. (*b*) In both tubes at the same time or (*c*) twice in the same tube. The most frequent cause is an inflammatory alteration of the tubes. These pathological changes involve chiefly the tubal mucosa, they are not intense. If they were intense, they would prove an obstacle to fecundation. The prognosis is not fatal. Between two ectopic pregnancies there may be a normal uterine pregnancy. The diagnosis after opening the abdominal wall is confirmed by the presence of the fœtus, by the presence of the decidual cells, or by the demonstration of chrorionic villi in the removed tumor.

Simultaneous bilateral ectopic pregnancies are rare. The author has been able to find but nine cases. In the course of a laparotomy for extrauterine pregnancy, the opposite adnexa must be always examined. A fœtus of the same age may be found or instead one may find a fœtus of a previous conception. Prognosis is good if operation be resorted to at an opportune time.

Aimé Paul Heineck.

Appendicitis in Women and its Consequence upon the Sexual Organs. (Die Appendicitis Beim Weibeuihre Bedeutung für die Geschlectuorgane.) Dr. Pankow. *Beiträge zur Geburtsh and Gynæk*, b. xiii, h. i.

In a lengthy paper Pankow first describes the normal and pathological anatomy of the appendix, the frequency and prognosis of appendicitis in women. He gives the histories and pathology of cases of appendicitis which prove the passing of the inflammatory process from the appendix to the adnexæ and *vice versa*. He reports cases of sterility following appendicitis, adhesions occluding the tubes. He refers to the importance of chronic appendicitis, to the similarity of its clinical symptoms with the clinical symptoms of ren mobilis, oöphoritis chronica, and retroflexio uteri mobilis. The difficulty to differentiate between them and between hystero-neurasthenia is considerable. The clinical symptoms produced by the above-named conditions allow different interpretations and errors are unavoidable. A movable retroflected uterus, a ren mobilis or an enlarged ovary present do not allow the saying, that the etiology of all complaints has been found. In neurasthenics and hysterics symptoms simulating appendicitis are not at all rare. He reports two cases of hysterics in which the history, the examination, and observation tended to the diagnosis of appendicitis, while the extirpated appendix proved histologically perfectly normal. On the other hand he reports two cases where the diagnosis tended much more towards hysteria, nevertheless the operation revealed in one case an appendix completely obliterated, in the other extended inflammatory condition. There are cases in which we neither by clinical observation nor by histological examination of the appendix, nor by careful observation of the patient after the operation can give the exact cause of the trouble. The suggestive power of the operation will be enough to stop all pains and complaints for a long time.

Appendicitis during pregnancy has a worse prognosis than otherwise. An acute attack of appendicitis during pregnancy should be operated upon immediately, at all stages of pregnancy, but especially if it occurs in the latter part. The incision should be somewhat more lateral and higher. Errors with pylitis dextra and ureteritis or neuralgia are during pregnancy hard to

avoid; report of such cases. If a woman becomes pregnant, who previously had an attack of appendicitis, operation should be advised, having in mind that the growing uterus, sudden contraction during labor, and the sudden emptying of the uterus is dangerous in this respect, that adhesions might be torn and a latent inflammatory focus spread. Abscesses in the Douglas are not found in the latter months of pregnancy, while in the earlier months they might be opened through the vagina. In a case of appendicitis followed by a large abscess towards the end of pregnancy, he advocates first to empty the abscess, then carefully the uterus, by vaginal Cæsarean section, thus avoiding the possible rupture of adhesions and spreading of the pus. In cases in which the uterine cavity became infected, the question arises whether it would not be advisable to do a supra-vaginal amputation, but experience teaches that these uterine infections are strikingly well overcome. HELIODOR SCHILLER.

Cysts of the Uterus. (Les kystes de l'utérus.) S. MERCADÉ. *Rev. de Gyn. et de Chir. abdominale*, 1907.

The author in his work eliminates cystic degeneration. He describes five varieties of uterine cysts. First, the mucous or follicular cysts of the corpus uteri. They are not frequent. They are due to glandular hypertrophy of the uterus. They are usually multiple. They are often overlooked and are diagnosed only when they prooject through the cervix uteri.

Second, hydatid cysts. They may be primary or secondary. The first are due to infection by means of the blood channels or lymphatic vessels. The secondary are due to metastases. The cyst may be subperitoneal, submucous, or interstitial. Subperitoneal cysts are frequently confounded with ovarian or tubal cysts. Submucous cysts are frequently diagnosed pregnancy, polypi, hydatiform mole.

Third, embryonic cysts. They are situated in the uterine parenchyma near the uterine cornua. Their wall is lined by a layer of ciliated or non-ciliated cylindrical epithelium. They are apparently of Wolffian origin. Clinical diagnosis is never made.

Fourth, serous cysts described by Huguier and Lebert.

Fifth, blood cysts of two kinds. They may be due to obliteration or to rupture of an angioma. Others are due to transformation of pre-existing cysts. In both cases the attention of the clinician is directed by hæmorrhages that do not yield to curettage, and by severe pelvic pains. Late in the course of the affection, a palpable tumor is detected. In these blood-cysts, total hysterectomy is the only method of treatment.

AIMÉ PAUL HEINECK.

Internal Secretions of the Ovary. (Secrétion interne de l'ovaire.) M. JARDY. *Thise*, Paris, 1907.

The ovary has an internal secretion. This is evidenced by the fact that the suppression of this gland determines important disturbances. For the cure of these accidents, organo-therapy and organ implantation are necessary and sufficient. This secretion is elaborated in two different centers: the corpus luteum and the interstitial cells. Two functions are performed by this secretion. The role of the corpus luteum secretion in gestation is to prepare and to assure the fixation of the ovum; in the non-pregnant state, it probably determines the menstrual flow. The secretion of the interstitial cells has an important role in activating the metabolism and nutrition of the tissues.

Ovarian transplantation is justified by experimental and clinical observations. To a certain extent, the thyroid gland by hypertrophying can compensate for lack of ovarian secretion. AIMÉ PAUL HEINECK.

Cystic Degeneration of the Ovaries after Certain Operations for Inflammations of the Uterine Adnexæ. (Dégénérescence kystique des ovaires après certaines interventions pour annexites.) VAUTRIN. *Archives générales de Chirurgie*, 1908, vol. ii, No. 6. p. 633.

If one ovary is removed, the remaining ovary for a time hypertrophies. It shows then a tendency to atrophy. After hysterectomy, alterations take place most always in the ovarian tissue. These alterations consist of a hyperplasis of the perifollicular connective tissue. This follicular hyperplasia appears to interfere more or less with the development and maturation of the follicles. Therefrom results a sclerosing atrophy of the entire follicular apparatus. Even in this stage it is not infrequent to notice persisting cystic degeneration of some follicles. If in a rabbit one of the uterine cornu of the uterus is resected, these changes almost always are limited to the ovary of the corresponding side. The alteration evolutes gradually and slowly. It is important in gynecological practice that not only the ovary be preserved, but also that its neuro-vascular relations be undisturbed. Cystic degeneration of the ovary causes pain and serious compression symptoms. An ovary included in pelvic exudates necessitates for its removal very judicious operating. Simple colpotomy is not a suitable operation for these cases.

AIMÉ PAUL HEINECK.

Dermoid Cysts of the Ovary Containing Thyroid Tissue. (Kyste dermoide de l'ovaire, contenant du tissu throidien.) VIOLET. *Exposé de titres à l'agrégation*, 1907.

In the ablation of dermoid cysts of the ovary, it is possible at times to be conservative. To remove the cyst and to leave part or the entire ovary is, in some cases, possible. In the macroscopical examination of the usual forms of dermoid cysts, many different tissues are, at times, to be found. In one of his cases, the author found a mass of lymphatic tissue. In another case, he found thyroid tissue. Some of the dermoid cysts were lined with a cutaneous wall. Some were lined with cylindrical epithelium. In the walls of some of these dermoid cysts, small serous or mucoid cysts are not infrequently present.

Dermoid cysts, may be unilocular, may be multilocular. In the multilocular dermoid cysts, only one pocket was dermoid, the others being serous or mucoid. In 1902, Guéniot and Loewy reported in the Révue de gynécologie et de chirurgie abdominale, 97 cases of bilateral dermoid cysts of the ovaries.

AIMÉ PAUL HEINECK.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF OBSTETRICS

UNDER THE CHARGE OF

C. S. Bacon, M. D. — Rudolph W. Holmes, M. D.
C. v. Bachellé, M. D. — Hugo Ehrenfest, M. D.

Histological Changes in the Vagina and Bladder during Pregnancy. (Histologische Besonderheiten der Vagina and Blase während der Gravidität.) I. Hofbauer. *Monatschr für Geburtshilfe & Gynæk.*

Systematic microscopical examination of maternal organs during pregnancy and puerperium disclosed histological changes, which are found with a certain constancy and therefore can be called typical. Of eight vaginas of pregnant he found in three a metamorphosis of the epithelium, in place of the stratified squamous epithelium there was a transitional epithelium respecting a stratified cylindric epithelium, the cells resembling glandular cells. Besides this were papillary excrescences covered with a thick epithelial layer. In animals this epithelial metaplasia is well known. In the connective tissue of the vagina he found round cell infiltration and large oval cells, typical polyblasts or plasma cells. In the bladder he found the muscle fibres hypertrophied, some fibres were 9m. broad. This increase concerns mostly the external muscular layer and is distinctly found in the lower part of the ureter. This hypertrophy as well as round cell infiltration explains the clinical fact that the ureter during pregnancy is easily palpable through the vagina, and the peculiar cystoscopic picture of the papilla ureteris, the ureteral orifices in some cases of pregnant were found rigidly patent. Very interesting is the observation of transversely striated muscle fibres in the bladder of a pregnant, who died of diabetis coma. Hofbauer was able to prove by microscopic pictures the metamorphosis of the cone into transversely striated elements. Besides this he found round cell infiltration in all layers and typical plasma cells. In two cases the epithelial layer of the bladder showed active proliferation, broad solid cones of epithelium extended deep in the underlying tissue. Heliodor Schiller.

Fibroma and Puerperium. (Fibromes et puerpéralité.) J. Jamain. *Thèse*, Paris, 1907.

Before the age of thirty fibromata of the uterus are rare; after that age they increase in frequency. Pinard states they are relatively frequent in women who have not been fertilized. When pregnancy takes place in a fibromatous uterus, the course of pregnancy, in a large proportion of cases, is normal. At times, not frequently, the evolution of the pregnancy is disturbed by complications: compression symptoms, torsion, peritoneal reaction, excessive volume of multiplicity of tumors hæmorrhages, ordinarily related to a vicious insertion of the placenta, increase degenerative changes or development of the fibroma. These complications necessitate surgical intervention.

Intervention will be according to the conditions present, conservative (myomectomy) or mutilating (hysterectomy). Some authors, influenced by the seat, the shape, and the volume of the tumor, recommend for some cases the vaginal route, for others, the abdominal route. Jamain recommends that the abdominal route be always employed.

Labor and delivery are more often normal than abnormal in women having uterine fibroma or fibromata. Vicious insertion of the placenta, pelvic presentations, slowness of expulsion, are however more frequent than in normal parturients. Exceptionally these fibromata may cause dystocia. If the tumor be very voluminous or impacted, if there be alarming hæmorrhages, surgical intervention is indicated. The intervention may be conservative (Cæsarean section) or may be mutilating (total or subvaginal hysterectomy). Fibromata may suppurate. In women having fibromata, Pinard says that nursing causes a regression of the tumors. According to Pinard, the best prophylactic for uterine fibromata is that women be urged to observe "the harmonious rhythm of reproduction." Women should be fertilized young, should nurse their offsprings and should avoid secondary sterility. Aimé Paul Heineck.

Some Investigations about the Development of the Bony Pelvis Post Partum. (Zur Entwicklung des Knochernen Beckens nach der Geburt.) *Beiträge zur Geburtshilfe and Gynæk.* b. xiii, h. i.

The pelves of new-born lambs do not show sexual differences. The pelves of full-grown lambs are sexually well differentiated. The pelves of the male animals are large, the bones compact and rough, the true pelvis is narrow and long. The pelves of the females are smaller, the bones not as massive, the true pelvis short and roomy. If the new-born lambs are castrated the development of the bones of the pelvis is retarded. The epiplyses in the pelves of the castrated animals remain cartilaginous. The pelves of the male castrates are smaller, the true pelvis is wider, the pelves of the female castrates are smaller than the average, the true pelvis less wide. The male and female pelves of the castrated animals are similar, there are very few and slight sexual differences, probably the bones of the female remain more massive and rough.

The extirpation of the uterus of the new-born does not influence the development of the pelvis. If only a small part of the ovary is left, the development of the pelvis will be normal. The sexual differences of the pelvis are conditioned by the sexual glands, the ovaries, and testes. After extirpation of the ovaries at an early age, pelves result which are in the middle between the male and the female pelvis, with very slight sexual differences.

HELIODOR SCHILLER.

Hour-glass Contraction of the Uterus During Labor. ELMER SOTHORON, M. D., Washington, D. C. *American Journal of Obstetrics*. September, 1908.

The various causes of spasmodic contraction of the uterus, commonly called hour-glass contraction, have been given by a number of writers. The most common ones suggested are irritation within the uterus, abuse of ergot, abnormal adherence of the placenta, and prolonged use of chloroform or ether.

Some have thought that this irregular contraction could take place only when the placenta was attached to a side of the uterus, others only when it adhered to the fundus. Budendorf, Aschern, Péan, and other writers have recorded cases where a portion of the placenta was inserted in the uterine end of the Fallopian tube. While the location of the placenta, as just mentioned, may act as a factor in these cases, yet I do believe that the majority of them are caused by either one of the following two conditions:

1. An abnormally adherent placenta acting as an obstacle to contraction over the placental site, while the rest of the organ assumes its physiological function. The uterus, seeming to recognize the fact that an extra effort is required to throw off the adherent placenta, contracts with unusual vigor. The site of the placenta, being the weakest part of the uterine wall, contracts with the least energy and remains in a state of comparative inertia, and so the placenta becomes encysted.

2. The premature rupture of the membranes and the loss of the entire amount of amniotic fluid, either spontaneously or gradually, allows the uterus to retract at a certain place, and conform itself to the surface of the fetus. After the expulsion of the child, the retracted portion of the uterus being free assumes its physiological duty, thereby forming this annoying central stricture. This stricture is either the internal os or the ring of contraction (Bandl).

Artificial irritation by too frequent examinations, and awkward application of forceps have been mentioned as a prominent factor by some writers.

Meddlesome midwifery has undoubtedly a great deal to do in bringing about this condition, such as the early rupture of the amniotic sac, the abuse of ergot and other drugs as mentioned, and the too hasty attempt to deliver the placenta by traction on the cord, but I do believe sometimes an abnormally adherent placenta will produce this condition in spite of the physician's best attention; in fact, he has no way to prevent it, as the contraction or stricture is forming while the birth of the child is engaging his attention.

Treatment should depend upon two conditions:

1. A partly adherent placenta contained in a cavity whose walls are poorly contracted, thereby producing hæmorrhage.

2. A retained non-adherent placenta contained in a cavity whose walls are firmly contracted and with little or no hæmorrhage.

In this condition, especially in a case with more or less hæmorrhage, it becomes always a matter of necessity to operate, and this should be undertaken as soon as this situation is ascertained.

Following are author's conclusions:

1. Avoid meddlesome midwifery, such as early rupture of the amniotic sac before it has thoroughly performed its function as a dilator or distender.

2. Avoid the use of ergot or other drugs of similar action until the completion of the third stage of labor.

3. Avoid interference with normal uterine action by the prolonged use of chloroform or ether.

4. Avoid the danger of stimulating spasmodic uterine contraction as well as danger of rupture of the cord by an attempt to deliver an adherent placenta by traction on the cord.

FRANK W. VAN KIRK.

Pelvic Measurements of Living Japanese Women. (Beckenmessungen an Japanerinnen.) (Beckenmessungen on Japanerumen.) OGATA. *Beiträge zur Geburtshlfe and Gynæk.* b. 13, h. 1.

The average pelvic measures of 500 Japanese women are:

	Japanese	German	Difference
Conjugata externa	18.19	20	2 c. m.
Distancia spin arum ossis ilei	23.20	25	2 c. m.
Distancia ossis cristar	25.75	28	2 c. m.
Distancia ossis trochant	27.61	32	4 c. m.
Circumference	78	89	11 c. m.
Height	146.31	158	12 c. m.

In another series of 225 examinations, where robust women were selected, the average measures were as follows:

19	20
23	25
26	28
28	32
79	89
147	158

Another series comprises 44 examinations of women of the hard-working class, hard farm-work principally:

		Average not working
Conjugata externa	18.90	18.19
Distancia spinarum	25.60	23.20
Distancia crist	27.60	25.55
Distancia troch	28.70	27.60
Circumference	79.5	78
Height	144	146

These measures confirm the findings of other men, that work develops a stronger and roomier pelvis. Work and exercise has much more influence upon the development of the pelvic bones than the height of the body. Contracted pelves are rare in Japan. Among one thousand women examined there was only one flat rhachitic pelvis and one oblique contracted pelvis.

HELIODOR SCHILLER.

BOOK REVIEWS

INTRODUCTION TO THE CLINICAL STUDY AND TO THE PRACTICE OF OBSTETRICS. Anatomy, Presentations and Positions, Mechanism, Palpation and Maneuvers, Extraction by Breech, Version, and Forceps. By Professor L. H. Farabeuf and Doctor Henry Varnier. Preface by Professor Henry Pinard. Third edition, revised and elaborated by Professor Farabeuf. G. Steinheil, Printer, 2 Rue Casimir — Delavique, Paris.

Practitioners and students both old and young should hail with pleasure the reappearance of this splendid work, now long out of print.

Upon the death of Varnier his task fell to Prof. Farabeuf, and in this edition the text has been revised and emended by him.

We find here all the instruction necessary to the understanding of labor in its mechanical aspects, whether by vertex, breech, face, or shoulder.

The first chapter is a description and representation of the maternal parts, osseous and soft, exceptionally well done, and followed by a study of the fœtal head and the various presentations and positions, all drawn from nature. In Chap. II, the mechanism of labor is considered in 50 pages, with 40 illustrations.

Vertex, face, breech, palpation, and diagnosis of all the positions of each presentation are liberally treated Manual aid in labor by the breech takes 60 pages, with 40 illustrations version 75 pages with 60 illustrations, while the use of forceps, with 90 pages and 122 figures, is carefully and thoroughly elucidated. The work is based on the experiments and maneuvers conducted for five years upon the female body with a fœtus kept soft by glycerine. These experiments, resulting in many new ideas, were controlled by daily observations on the living in Pinard's clinic. One cannot conceive a work more valuable or necessary to one interested in obstetrics, the practical study of which requires a special preparation in anatomy, mechanical exercises, and instrumental maneuvers.

There is no department of surgical technique so frequently underrated and so little understood as obstetrics, while at the same time there is no technique so difficult to acquire as obstetrical facility.

The various operations in the pelvis and upon the abdomen are trivial in their simplicity as compared with the large obstetrical interference, which demands the highest degree of judgment and manual dexterity. By the same token, no operation is so common as the obstetrical operation, and as a result of this combination the world is full of gynecological cases. Hence, too, the necessity for such a work as Farabeuf's, who realizing this need instituted classes as early as 1879 for the demonstration, of palpation and obstetrical maneuvers on the manikin.

A competent book is however a necessary adjunct to such a course, as it enables the student to acquire a more comprehensive understanding of the study in a shorter time.

Such a work now presented by Prof. Farabeuf is unhappily not to be found in English.

It is a book of didactic instruction, written by teachers, and exhibiting the verifying and correcting methods of the laboratory. Besides the elementary and classic work is found much that the authors have illumined by their own enthusiastic consecration.

Their system is perfect. Every demonstration is geometrically complete even to its corollary before the next is undertaken. The insistance upon *method* is everywhere emphasized, and while such a system necessitates a few repetitions, it is quite acceptable and the repetitions and cross-references cannot be too frequent for the earnest student.

The illustrations are so numerous that the text seems almost superfluous, except for the necessary explanations. It is impossible to read the work attentively without obtaining a comprehensive knowledge of obstetrical mechanics.

Being devoted to physiologic conditions, the mutilating operations have been omitted, and probably for this reason also, that mechanism has been omitted which concerns breech delivery with posterior rotation of the back.

The technique and operative maneuvers conform in almost every detail to the manikin work as we give it here in Chicago — the only gross difference being in the use of the forceps to rotate the occiput forward from posterior positions — a practice that is quite rare in this country. The author has very justly taken strong grounds against the murderous use of forceps at the superior strait. This operation is becoming more and more rare and is here formally condemned.

With the simple, efficient, and relatively innocuous operation of pubiotomy in our hands, the use of the axis-traction instrument should be abanoned.

The book is elegant in appearance, well bound and printed. It is indispensable to the student or physician who wishes to follow successfully the mechanics and clinical findings of obstetrics.

The particular fact that constantly annoyed the reviewer while reading this classic work was the regret that it was not accessible to English readers.

C. B. REED.

MANUAL OF MIDWIFERY. By Thomas Watts Eden, M. D., C. M. Edin., F. R. C. P. Lond., F. R. C. S. Edin. Obstetric Physician and Lecturer on Practical Midwifery and Gynecology, Charing Cross Hospital, Physician to Out-Patients Queen Charlottes' Lying-Hospital, Surgeon to In-Patients Chelsea Hospital for Women, Examiner in Midwifery and Diseases of Women to the University of Oxford, the University of Leeds, and the Conjoint Board of the Royal Colleges of Physicians and Surgeons. Second Edition, 555 pages, with 42 plates and 236 illustrations. Price, 12/6 net. London: J. & A. Churchill. 1908.

In this second edition of his treatise on obstetrics the author has adhered very closely to the original plan and scope of the first edition. No effort is made to compete with the more exhaustive works on this subject, but rather to prepare a text-book suitable for the average student or practitioner, omitting no essentials in theory or practice, but eliminating collateral subjects and case reports. Hence there is no description of the anatomy of the female pelvis or mammary gland, full attention being paid however, to such subjects as placentation, pathology of pregnancy, the management of labor, and the various obstetrical operations. The present work is very little larger than the first edition, but it has been thoroughly revised, and many new and original illustrations have been added, most worthy of note being those descriptive of the application of forceps and of normal and contracted pelves.

The arrangement of the text is logical and in accordance with our own texts; the subject matter is presented clearly and concisely, though always from the British point of view. To the man trained in America or continental Europe it comes with something like a shock to observe management of labor, version, and forceps extraction described as performed with the patient in the lateral position. He advocates conservative treatment in eclampsia and, naturally enough, uses the Milne Murray axis-traction forceps in his operative work. Effort is made to break away from the older and misleading terms in nomenclature, and a compliment is paid to certain American authors by the reproduction of a few illustrations from their text-books. The author's views relative to ovulation, menstruation, and impregnation are in accordance with the recent work done in England in this particular branch of the subject. The publishers have produced a very dignified and attractive volume, one that compares favorably with the best we have.

CAREY CULBERTSON.

BOOKS RECEIVED

EMERGENCY SURGERY. By John W. Sluss, A. M., M. D. Philadelphia: P. Blakiston's Son & Co. 1908. Price, $3.50 net.

PATHOLOGICAL TECHNIQUE. By F. B. Mallory, M. D. and J. H. Wright, M. D. Fourth Edition. Philadelphia and London: W. B. Saunders Company. 1908. Cloth $3.00 net.

A TEXT-BOOK OF DISEASES OF WOMEN. By Charles B. Penrose, M. D. Sixth Edition. Philadelphia and London: W. B. Saunders Company. 1908. Cloth, $3.75 net; half morocco, $5.25 net.

GYNECOLOGY AND ABDOMINAL SURGERY. Volume II. Edited by Howard A. Kelley, M. D. and Charles P. Noble, M. D. Philadelphia and London: W. B. Saunders Company. 1908. Cloth, $8.00 net; half morocco, $9.50 net.

DISEASES OF THE SKIN AND THE ERUPTIVE FEVERS. By Jay Frank Schamberg, M. D. Philadelphia and London: W. B. Saunders Company. 1908. Cloth $3.00 net.

OBSTETRICS FOR NURSES. Third Edition. By Joseph B. De Lee, M. D. Philadelphia and London: W. B. Saunders Company. 1908. Cloth $2.50 net.

A TEXT-BOOK OF OPERATIVE SURGERY. Third Edition. By Warren Stone Bickham, M. D. Philadelphia and London: W. B. Saunders Company. 1908. Cloth, $6.50 net; half morocco, $8.00 net.

SURGERY OF THE URETER. By Benjamin Merrill Ricketts, M. D. Cincinnati, Ohio. 1908.

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THE GILLIAM OPERATION

EDITOR SURGERY, GYNECOLOGY AND OBSTETRICS:

In a paper by D. J. O. Polak in a recent (July) number of SURGERY, GYNECOLOGY AND OBSTETRICS he says of the Gilliam operation for uterine retrodisplacement "the chief disadvantage of the operation is, that it swings the uterus from the abdominal wall by its anterior face and does not sufficiently anteflex it to secure and maintain the intraabdominal pressure on its posterior surface. A second objection is the likelihood of suppuration in the wound." Of 33 of these operations by Dr. Polak, suppuration occurred in six. Two of the patients became pregnant and their uteri were found, one month after confinement, "low and retrodisplaced." If Dr. Polak's experience is common to this operation then, beyond question, it is not a desirable procedure. However, after having done the Gilliam operation more than one hundred times and never having found the uterus in the abnormal position in any of the many patients subsequently examined, nor observed a difference in the healing of the incision after this and other clean abdominal operation, I am constrained to believe the Doctor's technique was at fault and therefore, a very valuable, as I think, operation is likely to suffer unjustly by his publication. It is my opinion that the disadvantage first mentioned is only experienced when the ligaments are brought out too far above the pubes. In regard to the suppuration I may be pardoned for giving the method of securing cleanliness in use at the Laura Hill Hospital, where my work has been done. Everything that can be is boiled. Pans, sheets, towels, sleeves, and gauze sponges are boiled from one to two hours. Rubber gloves, instruments, and suture material, including catgut (hardened by formaldehyde) are boiled twenty minutes. Gloves are never used after having been in a pus case. Buried sutures are of catgut. Silkworm-gut is used to bring the skin and subcutaneous fat surfaces together. The catgut is prepared fresh every day. The nurse prepares the field of operation by scrubbing it with soap and water, saturated solution of permanganate of potash, saturated solution of oxalic acid and bichloride of mercury, in 1 to 1,000 solution, before the patient leaves her room. When brought to operating room she is scrubbed with soap and water and solution of bichloride of mercury. Hands and arms of operator and assistants are prepared by being scrubbed with soap and water, sat. sol. permanganate of potash, sat. sol. oxalic acid, and 1 to 1,000 sol. bichloride of mercury (a modification at Johns Hopkins Hospital of Schatz's method). Gloves and sleeves are then put on. Recognizing the fact that every assistant increases the danger of infection, the operating force is limited to three, viz.: the chief operator and two regular assistants.

Now, I do not want to be understood as contending that this is the only or even best way of securing cleanliness. I am quite sure, however, that not one of fifty Gilliam operations will suppurate if it is properly carried out.

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UTERINE DISPLACEMENTS

EDITOR SURGERY, GYNECOLOGY AND OBSTETRICS.

Dear Doctor: The October issue of your journal gave such a prominent place to the subject of the surgical treatment of uterine retrodisplacements, so-called, that it cannot fail to bring this question again prominently to the attention of the gynecologists.

On reading the articles one is deeply impressed with the confusion of the professional mind on this branch of gynecology, and of the long distance gynecologists seem to be from a scientific understanding of the subject. Four years ago I read a paper before the Chicago Medical Society on "The Present Status of Surgical Intervention in Retrodeviations of the Uterus," which was published in the A. M. A. Journal. The paper was held so long before publication that I became very apprehensive lest it would be out of date when published. I had found such overwhelming evidence against the round ligament operations and against all manner of hysteropexies, that I could not conceive it possible that surgeons would continue to subject women to such useless and dangerous operations. But, alas, when in the course of human events my article finally appeared, it was contemporary with new modifications of the Alexander operation and with new methods for performing ventral suspension and fixation, and the methods have multiplied with the years.

And now comes a new Richmond in the field — the broad ligament. The round ligament having signally failed, the broad is now brought into requisition. This last is, however, founded upon a theory so contrary to all principles of anatomy, and to nature's law of repair, that one may confidently predict for it a short career. Dr. R. C. Coffey, in an elaborately illustrated article, makes the statement that the general scheme of nature is to hang all abdominal organs by peritoneal ligaments. A study of splanchnoptosia contradicts this proposition flatly. It has been repeatedly demonstrated that prolapse of the viscera is in direct proportion to the relaxation of the abdominal wall, and that the great factors in maintaining

the relative position of the viscera are the integrity of the abdominal wall and of the pelvic floor and the consequent unimpaired action of the intraabdominal pressure, a force which Dr. Coffey practically ignores. He makes the astonishing statement that the peritoneum is non-elastic. It is impossible to know exactly what he means by this statement, as he goes on to say that it is held loosely in contact with the abdominal wall by a somewhat loose elastic connective tissue. If he considers as the peritoneum proper only the one layer, ignoring the connective tissue layer, which is abundantly supplied with elastic tissue fibres, he is certainly begging the question, as from a surgical standpoint it is impossible to make any such division of the peritoneum as a membrane.

His next proposition, in regard to the blending of peritoneal surfaces held aseptically in apposition, is equally fallacious. If this were true it must entirely revolutionize all known principles of physiology and pathology. It is precisely the one condition which may not be present if two serous surfaces are to lose their endothelial covering and become obliterated. Before this can happen the endothelial cells must be traumatized, the peritoneum desquamated, either by direct mechanical trauma or by some infectious process. The union of peritoneal surfaces by contact may be an embryonal or developmental process, but the theory falls utterly when applied to adult processes. That the folds of the broad ligament, when brought together as described in Dr. Coffey's operation, do sometimes unite, can be readily believed, as in handling the peritoneum ever so carefully we cannot fail to abrade this delicate serous membrane of many of its endothelial cells. But the operator is quite as likely to traumatize the portion of the broad ligament which he leaves exposed to contact with other serous surfaces which may be abraded, and thus favor the formation of adhesions, which so frequently follow abdominal operations.

As is customary when any new method of surgical procedure is announced, Dr. Coffey precedes the description of his own operation by discrediting all previous operations having the same object in view. He makes the equivocal statement that some of these methods "have been successful as success goes in surgical cases." It would be interesting to know what Dr. Coffey considers a surgical success. He divides all methods previous to his own, about seventy, I think, into five "types," claiming his operation as a sixth type.

Of the first type, after giving its advantages, he says: "It has the disadvantages that many patients have difficult labors afterwards. Many of them, while the uterus remains in position, still have the old backaches and nervous symptoms."

The second type he says, "has been *more or less* successful and has been used by many, but has never become generally popular because of the inability of the surgeon to treat diseased conditions which are *usually present accompanying the displacement.*" (Italics mine.)

The third type he claims as a very successful procedure, but admits a "chief drawback in the 'continuous backache," and adds most scientifically: "I think we are justified in suspecting that this pain is due to the *fixing of a movable organ which is part of the uterus.*" (Italics mine.)

The best that he can say for the fourth type is that it is "one of the most rational" of these operations.

The fifth type he says "is probably the best." And yet Dr. Coffey is brave enough to present a sixth type.

It is unfortunate that such doubtful surgical procedures should be so beautifully illustrated. The already inflamed imagination of the amateur is brought to white heat, and he makes haste to try the operation on a living subject.

In "Further Studies" of this last and sixth type Dr. C. N. Suttner has found the operation of no value in relaxed pelvic floor, general visceral ptosis, and heavy uteri. With these conditions excepted it is difficult to see what cases could present themselves for operation, excepting the normally movable uteri or those complicated with a diseased condition of other pelvic organs, in which case I claim the uterus itself is in no need of surgical treatment.

Dr. Suttner has travelled leagues beyond his teacher in his experimenting on this "sixth type," by subjecting two pregnant women to this operation. Up to this time it has been a tacit understanding among surgeons that the abdomen of a pregnant woman should be opened only as an emergency procedure. Dr. Suttner has, to say the least, the courage of his convictions.

The surgical craze which seems to dominate the professional world at the present time is rapidly discrediting us with the laity, and it will be well for the profession when all gynecologists learn the lesson which Schultze has been teaching us for a quarter of a century, that a normal uterus is a movable uterus, and that any pathological process or surgical procedure which interferes with this normal mobility compromises all of its functions.

LUCY WAITE.